SECTION 1

RESOURCES FOR WORKSHEET PREPARATION

PART A

POPULATION ESTIMATES
2000
CITIES AND COUNTIES IN CALIFORNIA

2000 POPULATION ESTIMATES FOR CITIES IN CALIFORNIA, BY COUNTY

CALIFORNIA POPULATION
AS OF JANUARY 1, 2000

TOTAL: 34,336,000

CALIFORNIA	**34,336,000**
ALAMEDA	**1,454,300**
ALAMEDA	73,700
ALBANY	17,850
BERKELEY	109,500
DUBLIN	32,500
EMERYVILLE	7,300
FREMONT	208,000
HAYWARD	129,600
LIVERMORE	74,300
NEWARK	43,050
OAKLAND	402,100
PIEDMONT	11,650
PLEASANTON	65,900
SAN LEANDRO	76,700
UNION CITY	67,200
UNINCORPORATED	134,800
ALPINE	**1,190**
UNINCORPORATED	1,190
AMADOR	**34,400**
AMADOR	220
IONE	7,100
JACKSON	3,870
PLYMOUTH	830
SUTTER CREEK	2,090
UNINCORPORATED	20,300
BUTTE	**204,000**
BIGGS	1,750
CHICO	55,400
GRIDLEY	5,050
OROVILLE	12,650
PARADISE	26,300
UNINCORPORATED	102,900
CALAVERAS	**38,500**
ANGELS CAMP	3,060
UNINCORPORATED	35,400
COLUSA	**18,750**
COLUSA	5,475
WILLIAMS	3,170
UNINCORPORATED	10,100
CONTRA COSTA	**930,000**
ANTIOCH	84,500
BRENTWOOD	23,100
CLAYTON	11,350
CONCORD	114,900
DANVILLE	40,500
EL CERRITO	23,850
HERCULES	19,550
LAFAYETTE	24,350
MARTINEZ	37,050
MORAGA	17,000
ORINDA	17,450
PINOLE	18,650
PITTSBURG	54,400
PLEASANT HILL	33,150
RICHMOND	94,400
SAN PABLO	26,850
SAN RAMON	45,700
WALNUT CREEK	64,700
UNINCORPORATED	178,600
DEL NORTE	**28,000**
CRESCENT CITY	8,200
UNINCORPORATED	19,850
EL DORADO	**152,900**
PLACERVILLE	9,325
SOUTH LAKE TAHOE	23,000
UNINCORPORATED	120,600
FRESNO	**805,000**
CLOVIS	70,700
COALINGA	15,200
FIREBAUGH	6,125

FOWLER	3,870
FRESNO	420,600
HURON	5,875
KERMAN	7,800
KINGSBURG	9,425
MENDOTA	7,850
ORANGE COVE	7,900
PARLIER	11,400
REEDLEY	20,950
SANGER	19,050
SAN JOAQUIN	3,260
SELMA	18,700
UNINCORPORATED	176,400
GLENN	**27,100**
ORLAND	5,875
WILLOWS	6,400
UNINCORPORATED	14,850
HUMBOLDT	**127,600**
ARCATA	16,400
BLUE LAKE	1,240
EUREKA	27,550
FERNDALE	1,370
FORTUNA	10,250
RIO DELL	2,940
TRINIDAD	360
UNINCORPORATED	67,600
IMPERIAL	**145,300**
BRAWLEY	21,900
CALEXICO	27,000
CALIPATRIA	7,550
EL CENTRO	38,300
HOLTVILLE	5,550
IMPERIAL	8,075
WESTMORLAND	1,770
UNINCORPORATED	35,150
INYO	**18,200**
BISHOP	3,440
UNINCORPORATED	14,750
KERN	**658,900**
ARVIN	11,850
BAKERSFIELD	237,200
CALIFORNIA CITY	8,775
DELANO	35,550
MARICOPA	1,250
MCFARLAND	9,450
RIDGECREST	27,300
SHAFTER	11,900
TAFT	9,150
TEHACHAPI	12,600
WASCO	20,100
UNINCORPORATED	273,800
KINGS	**131,200**
AVENAL	13,100
CORCORAN	21,550
HANFORD	41,000
LEMOORE	18,800
UNINCORPORATED	36,750
LAKE	**55,700**
CLEARLAKE	11,900
LAKEPORT	4,600
UNINCORPORATED	39,200
LASSEN	**33,950**
SUSANVILLE	17,100
UNINCORPORATED	16,850
LOS ANGELES	**9,884,300**
AGOURA HILLS	22,150
ALHAMBRA	92,800
ARCADIA	54,000
ARTESIA	17,150
AVALON	3,610
AZUSA	46,250
BALDWIN PARK	77,100
BELL	38,050
BELLFLOWER	68,300
BELL GARDENS	45,750
BEVERLY HILLS	35,100
BRADBURY	970
BURBANK	106,500
CALABASAS	20,450
CARSON	93,200
CERRITOS	58,100
CLAREMONT	35,950
COMMERCE	13,350
COMPTON	98,000
COVINA	48,000
CUDAHY	25,850
CULVER CITY	42,800
DIAMOND BAR	59,100

DOWNEY	102,100
DUARTE	23,000
EL MONTE	120,000
EL SEGUNDO	16,850
GARDENA	59,600
GLENDALE	203,700
GLENDORA	53,800
HAWAIIAN GARDENS	15,200
HAWTHORNE	80,500
HERMOSA BEACH	19,650
HIDDEN HILLS	2,050
HUNTINGTON PARK	63,600
INDUSTRY	690
INGLEWOOD	121,000
IRWINDALE	1,200
LA CANADA FLINTRIDGE	21,100
LA HABRA HEIGHTS	6,900
LAKEWOOD	81,000
LA MIRADA	49,900
LANCASTER	132,400
LA PUENTE	42,200
LA VERNE	34,800
LAWNDALE	30,850
LOMITA	20,950
LONG BEACH	457,600
LOS ANGELES	3,823,000
LYNWOOD	69,300
MALIBU	13,300
MANHATTAN BEACH	36,100
MAYWOOD	30,400
MONROVIA	41,050
MONTEBELLO	65,000
MONTEREY PARK	67,400
NORWALK	104,500
PALMDALE	122,400
PALOS VERDES ESTATES	14,750
PARAMOUNT	56,600
PASADENA	143,900
PICO RIVERA	65,200
POMONA	147,700
RANCHO PALOS VERDES	44,950
REDONDO BEACH	67,600
ROLLING HILLS	2,070
ROLLING HILLS ESTATES	8,775
ROSEMEAD	57,300
SAN DIMAS	37,350
SAN FERNANDO	24,700
SAN GABRIEL	41,600
SAN MARINO	14,000
SANTA CLARITA	151,300
SANTA FE SPRINGS	16,450
SANTA MONICA	96,500
SIERRA MADRE	11,700
SIGNAL HILL	9,250
SOUTH EL MONTE	22,700
SOUTH GATE	95,300
SOUTH PASADENA	26,000
TEMPLE CITY	34,750
TORRANCE	147,400
VERNON	85
WALNUT	33,200
WEST COVINA	107,600
WEST HOLLYWOOD	38,900
WESTLAKE VILLAGE	8,600
WHITTIER	86,200
UNINCORPORATED	1,036,300
MADERA	**117,100**
CHOWCHILLA	13,650
MADERA	37,600
UNINCORPORATED	65,800
MARIN	**249,700**
BELVEDERE	2,320
CORTE MADERA	9,100
FAIRFAX	7,200
LARKSPUR	11,950
MILL VALLEY	14,100
NOVATO	48,950
ROSS	2,310
SAN ANSELMO	12,450
SAN RAFAEL	54,800
SAUSALITO	7,825
TIBURON	8,900
UNINCORPORATED	69,800
MARIPOSA	**16,150**
UNINCORPORATED	16,150
MENDOCINO	**87,600**
FORT BRAGG	6,425
POINT ARENA	440

UKIAH	14,950
WILLITS	5,150
UNINCORPORATED	60,600
MERCED	**210,100**
ATWATER	22,550
DOS PALOS	4,460
GUSTINE	4,440
LIVINGSTON	10,550
LOS BANOS	23,250
MERCED	63,300
UNINCORPORATED	81,500
MODOC	**9,800**
ALTURAS	3,000
UNINCORPORATED	6,800
MONO	**10,900**
MAMMOTH LAKES	5,350
UNINCORPORATED	5,550
MONTEREY	**399,300**
CARMEL-BY-THE-SEA	4,630
DEL REY OAKS	1,710
GONZALES	7,150
GREENFIELD	10,750
KING CITY	10,850
MARINA	18,500
MONTEREY	33,350
PACIFIC GROVE	17,600
SALINAS	134,700
SAND CITY	200
SEASIDE	30,300
SOLEDAD	23,900
UNINCORPORATED	105,700
NAPA	**127,000**
AMERICAN CANYON	9,375
CALISTOGA	4,950
NAPA	71,400
ST HELENA	6,225
YOUNTVILLE	3,770
UNINCORPORATED	31,300
NEVADA	**91,100**
GRASS VALLEY	9,950
NEVADA CITY	2,920
TRUCKEE	12,900
UNINCORPORATED	65,300
ORANGE	**2,828,400**
ANAHEIM	310,700
BREA	36,950
BUENA PARK	77,300
COSTA MESA	106,600
CYPRESS	49,050
DANA POINT	38,000
FOUNTAIN VALLEY	56,900
FULLERTON	128,300
GARDEN GROVE	158,300
HUNTINGTON BEACH	199,300
IRVINE	144,600
LAGUNA BEACH	25,300
LAGUNA HILLS	31,000
LAGUNA NIGUEL	60,100
LA HABRA	56,800
LAKE FOREST	60,000
LA PALMA	16,550
LOS ALAMITOS	12,150
MISSION VIEJO	98,500
NEWPORT BEACH	75,600
ORANGE	129,400
PLACENTIA	50,200
SAN CLEMENTE	50,300
SAN JUAN CAPISTRANO	32,500
SANTA ANA	317,700
SEAL BEACH	27,400
STANTON	34,350
TUSTIN	68,300
VILLA PARK	6,775
WESTMINSTER	87,600
YORBA LINDA	63,100
UNINCORPORATED	218,800
PLACER	**234,400**
AUBURN	11,400
COLFAX	1,500
LINCOLN	9,675
LOOMIS	5,925
ROCKLIN	35,250
ROSEVILLE	74,200
UNINCORPORATED	96,400
PLUMAS	**20,350**
PORTOLA	2,080
UNINCORPORATED	18,250

RIVERSIDE	**1,522,900**
BANNING	26,000
BEAUMONT	11,000
BLYTHE	21,450
CALIMESA	7,750
CANYON LAKE	12,200
CATHEDRAL CITY	38,650
COACHELLA	23,050
CORONA	123,000
DESERT HOT SPRINGS	15,500
HEMET	62,800
INDIAN WELLS	3,560
INDIO	45,700
LAKE ELSINORE	30,350
LA QUINTA	24,250
MORENO VALLEY	141,300
MURRIETA	44,000
NORCO	25,900
PALM DESERT	37,650
PALM SPRINGS	43,500
PERRIS	32,350
RANCHO MIRAGE	11,950
RIVERSIDE	259,700
SAN JACINTO	26,100
TEMECULA	53,800
UNINCORPORATED	401,400
SACRAMENTO	**1,209,500**
CITRUS HEIGHTS	89,200
FOLSOM	52,700
GALT	18,050
ISLETON	850
SACRAMENTO	406,000
UNINCORPORATED	642,700
SAN BENITO	**49,800**
HOLLISTER	29,700
SAN JUAN BAUTISTA	1,630
UNINCORPORATED	18,450
SAN BERNARDINO	**1,689,300**
ADELANTO	15,600
APPLE VALLEY	57,000
BARSTOW	23,300
BIG BEAR LAKE	6,325
CHINO	66,700
CHINO HILLS	60,200
COLTON	47,350
FONTANA	117,400
GRAND TERRACE	13,550
HESPERIA	63,600
HIGHLAND	44,450
LOMA LINDA	22,300
MONTCLAIR	30,950
NEEDLES	5,925
ONTARIO	151,500
RANCHO CUCAMONGA	125,600
REDLANDS	67,800
RIALTO	83,700
SAN BERNARDINO	186,400
TWENTYNINE PALMS	15,100
UPLAND	68,800
VICTORVILLE	64,500
YUCAIPA	39,850
YUCCA VALLEY	19,200
UNINCORPORATED	292,300
SAN DIEGO	**2,911,500**
CARLSBAD	82,000
CHULA VISTA	174,300
CORONADO	24,650
DEL MAR	5,400
EL CAJON	96,600
ENCINITAS	62,100
ESCONDIDO	127,800
IMPERIAL BEACH	29,200
LA MESA	59,200
LEMON GROVE	25,950
NATIONAL CITY	55,400
OCEANSIDE	160,800
POWAY	49,300
SAN DIEGO	1,277,200
SAN MARCOS	53,900
SANTEE	58,300
SOLANA BEACH	14,350
VISTA	85,700
UNINCORPORATED	469,300
SAN FRANCISCO	**801,400**
SAN FRANCISCO	801,400
SAN JOAQUIN	**566,600**
ESCALON	5,825
LATHROP	9,975

LODI	57,900
MANTECA	49,500
RIPON	10,400
STOCKTON	247,300
TRACY	54,200
UNINCORPORATED	131,400
SAN LUIS OBISPO	**245,200**
ARROYO GRANDE	16,450
ATASCADERO	25,800
EL PASO DE ROBLES	22,900
GROVER BEACH	12,750
MORRO BAY	9,975
PISMO BEACH	8,625
SAN LUIS OBISPO	43,050
UNINCORPORATED	105,700
SAN MATEO	**730,000**
ATHERTON	7,525
BELMONT	26,150
BRISBANE	4,060
BURLINGAME	29,500
COLMA	1,290
DALY CITY	104,600
EAST PALO ALTO	25,100
FOSTER CITY	30,900
HALF MOON BAY	11,300
HILLSBOROUGH	11,700
MENLO PARK	31,800
MILLBRAE	21,400
PACIFICA	41,050
PORTOLA VALLEY	4,620
REDWOOD CITY	78,000
SAN BRUNO	41,750
SAN CARLOS	28,950
SAN MATEO	95,400
SOUTH SAN FRANCISCO	62,600
WOODSIDE	5,650
UNINCORPORATED	66,800
SANTA BARBARA	**414,200**
BUELLTON	3,910
CARPINTERIA	15,200
GUADALUPE	6,550
LOMPOC	43,300
SANTA BARBARA	92,800
SANTA MARIA	72,900
SOLVANG	5,375
UNINCORPORATED	174,100
SANTA CLARA	**1,736,700**
CAMPBELL	40,850
CUPERTINO	52,900
GILROY	40,150
LOS ALTOS	28,600
LOS ALTOS HILLS	8,300
LOS GATOS	30,450
MILPITAS	65,300
MONTE SERENO	3,470
MORGAN HILL	33,100
MOUNTAIN VIEW	76,000
PALO ALTO	61,500
SAN JOSE	923,600
SANTA CLARA	102,900
SARATOGA	31,300
SUNNYVALE	133,200
UNINCORPORATED	105,200
SANTA CRUZ	**255,000**
CAPITOLA	11,200
SANTA CRUZ	56,000
SCOTTS VALLEY	10,850
WATSONVILLE	38,100
UNINCORPORATED	138,800
SHASTA	**167,000**
ANDERSON	8,800
REDDING	79,600
SHASTA LAKE	9,425
UNINCORPORATED	69,200
SIERRA	**3,140**
LOYALTON	810
UNINCORPORATED	2,330
SISKIYOU	**44,200**
DORRIS	850
DUNSMUIR	1,910
ETNA	760
FORT JONES	640
MONTAGUE	1,330
MOUNT SHASTA	3,690
TULELAKE	890
WEED	2,950
YREKA	6,900
UNINCORPORATED	24,250

SOLANO	**399,000**
BENICIA	29,000
DIXON	15,550
FAIRFIELD	95,300
RIO VISTA	4,850
SUISUN CITY	27,250
VACAVILLE	91,500
VALLEJO	114,700
UNINCORPORATED	20,850
SONOMA	**450,100**
CLOVERDALE	6,425
COTATI	6,825
HEALDSBURG	10,450
PETALUMA	53,000
ROHNERT PARK	39,950
SANTA ROSA	142,000
SEBASTOPOL	8,025
SONOMA	9,400
WINDSOR	21,050
UNINCORPORATED	153,000
STANISLAUS	**441,400**
CERES	32,950
HUGHSON	3,620
MODESTO	188,300
NEWMAN	6,375
OAKDALE	14,950
PATTERSON	10,950
RIVERBANK	14,600
TURLOCK	53,500
WATERFORD	6,775
UNINCORPORATED	109,400
SUTTER	**77,900**
LIVE OAK	5,500
YUBA CITY	35,550
UNINCORPORATED	36,800
TEHAMA	**56,200**
CORNING	6,150
RED BLUFF	13,150
TEHAMA	430
UNINCORPORATED	36,400
TRINITY	**13,050**
UNINCORPORATED	13,050
TULARE	**368,000**
DINUBA	15,700
EXETER	8,625
FARMERSVILLE	7,700
LINDSAY	9,050
PORTERVILLE	37,600
TULARE	41,800
VISALIA	96,800
WOODLAKE	6,450
UNINCORPORATED	144,300
TUOLUMNE	**53,000**
SONORA	4,240
UNINCORPORATED	48,700
VENTURA	**756,500**
CAMARILLO	63,300
FILLMORE	13,250
MOORPARK	29,750
OJAI	8,250
OXNARD	160,300
PORT HUENEME	23,500
SAN BUENAVENTURA	103,500
SANTA PAULA	27,250
SIMI VALLEY	113,000
THOUSAND OAKS	120,700
UNINCORPORATED	93,600
YOLO	**162,900**
DAVIS	58,600
WEST SACRAMENTO	31,000
WINTERS	5,525
WOODLAND	46,300
UNINCORPORATED	21,450
YUBA	**60,700**
MARYSVILLE	12,250
WHEATLAND	1,980
UNINCORPORATED	46,450

PART B

SUPPLEMENTAL INFORMATION ON SUPPLY AUGMENTATION METHODS

SUPPLEMENTAL INFORMATION ON SUPPLY AUGMENTATION METHODS

A brief overview of supply augmentation techniques is provided to explain how such measures fit into the overall picture of required drought actions. After a basic understanding of the supply situation is reached, selection of appropriate supply augmentation methods can be made.

Dependable Supply

When a water year (or years) turns out to be very dry, a purveyor needs to make decisions on how much of the available supply to use and how much to carry over into the next year as insurance against possible subsequent drought years. Water managers should be aware that water needs tend to be greater during dry years because of the lack of rainfall and greater outside irrigation usage. Generally speaking, agricultural systems, especially those with a sizable fraction of annual crops, will tend toward minimum carryover. However, water purveyors with a significant percentage of total demand used for permanent agricultural crops should be aware that water use in this customer type often increases during dry years. For example, the Goleta Water District normally supplies 25 percent of yearly production to agriculture, mainly avocados. During 1989, residential customers reduced use by 45 percent, commercial by 25 percent and agriculture, with great difficulty, by only eight percent.

Municipal and industrial providers generally can achieve 35 percent reductions with only moderate economic impacts, and may base carryover levels on the ability to provide 65 percent of normal demand for several years. As a minimum, urban systems should always keep enough reserves to handle potential fire suppression requirements.

In assessing dependable supplies, a purveyor starts with current usable water storage and adds the amount of additional supply that was available during the worst year(s) of record. The amount to be carried over into the next year(s) would then be deducted from the total to yield the dependable supply for the current year. Allowance for evaporation and losses, if significant, should be deducted if these losses have not been accounted for in the worst year(s) estimate of supply. This supply would then be the amount available without special action. Because the risk of the next year being the driest of record is small (at least until the season is well underway), most water agencies choose to define a dependable yield as that which can be obtained in about 90 percent of the years. However, it is useful to be able to make a simple assessment of the water supply situation periodically throughout the rainy season. A so-called "rule curve" is a good tool for this purpose.

Rule Curves

A rule curve is a simple graph that a water manager can use to estimate system water delivery capability as a function of runoff (or, in some cases, accumulated reservoir storage levels). There are many potential kinds of such decision curves but the simplest relates water year runoff (or projected remaining water year runoff) with project deliveries.

A simple single stream-single reservoir rule curve would be constructed by adding expected storable and divertable inflow to current starting storage, then subtracting the storage reserve needed at the end of the water year to yield the total amount deliverable. The storable inflow for more complicated systems may need to be determined from operation studies which simulate monthly operation over a long period of historical record. The resulting annual supply available is plotted on a chart with runoff (see Figure E-l). Runoff forecasts are updated as the season progresses and the manager has an immediate estimate of water supply from the rule curve.

Most forecasts of runoff assume median future weather. However, many forecasters, including the Department of Water Resources (DWR), include an 80 percent band range, (from 90 percent sure to only 10 percent sure). The 90 percent figure means that there is a one in ten chance that actual runoff will be less and the 10 percent figure means only one chance in ten of wetter conditions. The statistical range is based on historical patterns to project future weather conditions. Thus, a manager can select the 90 percent sure projection and estimate from the rule curve what the likely supply will be.

For large complicated systems, the initial rule curve estimate may need refinement or confirmation by more detailed water system operation studies. But the larger agencies with the more complex supply systems generally have the technical staff to be able to update estimates periodically.

One of the virtues of a rule curve is that it can show water customers at a glance where their supply system stands as a function of runoff. Water users can readily see how their supply of water relates to the wetness or dryness of the year and it drives home the point that water availability depends on the weather and is not an assured quantity.

DWR uses a rule curve to determine water delivery schedules for State Water Project (SWP) contractors. The specific rule curve for the next year is presented in draft form to contractor representatives each November. Following the initial DWR precipitation and runoff forecasts, made soon after December 1, initial approved delivery schedules and a preliminary Plan of Operation are established for the next year. As forecasts change under subsequent monthly surveys, delivery schedules can be revised upward accordingly. Mer the final seasonal forecast on about May 1, DWR prepares the final Plan of Operations for the year.

If it is necessary to augment available supplies, many possibilities can be considered. Several supply augmentation measures are described below.

Prepare to Switch to Groundwater Where Possible

Ground water represents a reserve supply source. Ground water extraction can be increased by:
I. Withdrawing previously banked groundwater.
2. Drilling new wells.
3. Reactivating abandoned wells.
4. Redrilling existing wells to greater depths.
5. Leasing private wells.

For example, by the end of the severe 1984 Texas drought, the City of Corpus Christi developed an additional 25 million gallons per day (mgd) from ground water wells. Three new city wells

produced 2.7 mgd. Reactivating wells that had been originally drilled for a drought during the 1950s produced another 18.4 mgd. During the 1984 drought, the City of Corpus Christi also made provisions to lease private wells.

The first step is to gather all the data available on groundwater resources and its availability in your district. Review and comparison of the local, historical drought experience can be rewarding. Answer the following questions: Are water tables higher or lower than before the last drought? How much did water tables fall during the last drought? To what extent did ground water substitute for surface supply deficiencies during the last drought? How much new demand has been added since the last drought? Has any groundwater overdraft or contamination occurred since the last drought? Are there unused wells of marginal water quality, which can be used temporarily or by blending with better quality supplies? What kind of problems, if any, developed in previous droughts and what was done to alleviate the problems? (For example, added extractions from deeper wells may cause some shallower wells to go dry.)

The second step is to ensure that all potentially usable wells are in good working order. Where it can be determined from the data review in the first step that groundwater levels will decline so that the well would run dry, consider deepening prior to the months of high demand.

For wells which have not been in use, inspect and prepare them for use. Such preparation might include surging and cleaning the wells as well as pumping to insure the well is capable of producing water. Rehabilitation of large capacity wells may cost several thousand dollars each, so purveyors may wish to check what is needed and where services can be obtained but hold back until the water supply is needed. However, be aware that during droughts the demand for new wells and rebuilding old wells exceeds the capability of well drillers.

The third step would be arranging for power hookups. If many abandoned wells are put back into service, the number of pumps, pump motors, and electrical transformers available for use might be too small. In prior droughts in California, the lack of transformers was a limiting factor. This may limit the amount of groundwater available for use. An early assessment of the need for groundwater pumping equipment improves the chance of adequate water supply. Also, the power needs of the pump motor must be considered, including the time needed to provide power hookups. Power could be limited because of reduced hydroelectric power generation. In some cases, diesel power could be used to drive the pumps.

Other early actions which could be taken are relaxation of controls on groundwater pumping in adjudicated basins. There are inherent problems to such actions which make their implementation slightly more difficult. An adjudicated basin is the result of judicial decision reached after many hours, days, or even years of testimony from parties involved in the suit. The procedure for modifying such a judicial decision would have to be worked out by the court and legal representatives of the parties. Relaxation of controls requiring court approval may not be practicable during dry years. Some decrees, however, include useful mechanisms for responding to dry years. Examples include use of temporary surplus water and the transfer of right to use decreed water. Adjudicated basins are managed by water masters or water mastering organizations, sometimes a committee or a water district. The manager of the basin must be contacted to determine what options are available for responding to dry year conditions.

Finally, the accelerated use of imported water temporarily stored in the ground of adjudicated basins may be possible. The use of such water will probably be subject to regulation by a water district.

Decrees determine the relative rights to the use of the "safe yield" of an adjudicated basin. Some basins add "temporary surplus" to the amount that may be pumped. Safe yield means that amount of water which may be taken from a basin year after year giving recognition to the cyclical long-range effects of precipitation on groundwater recharge.

In most areas of the state, additional groundwater use during a drought is only a temporary source of water supply. Eventually the underground supply must be replenished or there will be long-term detriments. Water levels in some basins will recover as surface supplies are again used after a drought. Many others, however, will require deliberate recharge programs to restore water levels.

Interconnections and Transfers

After examining prospects for local surface and ground water supplies, the next option may be to develop an exchange with another purveyor who has available water or who may be willing to share for a price. Informal transfers within districts were quite common during the 1976-77 drought. Interconnection of water systems can be quite ingenious. For example, in 1977, the Metropolitan Water District of Southern California diverted 400,000 acre-feet (AF) of additional Colorado River supplies, [thereby relinquishing an equal amount of its State Water Project (SWP) entitlement, which was in turn made available for purchase by those in need. Coachella Valley Water District, Desert Water Agency, and San Bernardino Valley municipal Water District also made 35,000 AF available from their 1977 allocation of SWP supplies for drought relief. Some of the water was transferred as far as Marin County, north of San Francisco in interconnected pipe systems from the South Bay Aqueduct, via City of San Francisco facilities, East Bay Municipal Utility District, and eventually an emergency pipeline over San Rafael Bridge. Most transfers are not that elaborate, but many will involve SWP and U .S. Bureau of Reclamation (USBR) canals and aqueducts.

Another recent example was the transfer of about 80,000 AF of stored water in New Bullards Bar Reservoir from Yuba County Water Agency to DWR in the summer of 1987. The extra Yuba releases allowed DWR to keep a like amount in storage at Oroville Reservoir.

To the extent physical interconnections at water system crossings can be readied ahead of time, a wise move may be to work out agreements and begin construction of physical works for potential use in a future drought or emergency situation.

Exchange arrangements do take some advance planning, especially if the districts do not share common facilities or contract with the same master agency for water supply. Exchanges between State and Federal water contractors are much easier to arrange. Water exchanges between agencies that do not share common facilities or contract with the same agency have been enhanced by recent State legislation.

However, before actual transfers take place, third parties may be involved. The State Water Resources Control Board (SWRCB) may have jurisdiction and often DWR and the USBR and other water rights holders and parties with environmental and wildlife issues are involved. Imposition of Federal Reclamation Law could be a factor where federal facilities are used to transport or transfer water to nonfederal users.

Changes in place of use to accommodate dry year water supply priorities may be accomplished by transfer and exchange interconnections between different agencies' distribution systems or by temporary extensions of conveyance facilities to serve new areas. However, approval by the State Water Resources Control Board will be required if such changes involve change in points of diversion, place of use, or purpose of use authorized in water right permits or licenses. Thus, water right petitions for change, filing of notices of transfers, or filing a temporary permit may be required before water may be legally used at the new location(s).

The following types of statutory transfer or place of use change petition procedures are authorized in the California Water Code (WC).

I. "Conditional Temporary Urgency Changes" (WC 1435)
2. Conventional "Changes in Place of Use" (WC 1700)
3. Notice of Temporary Change (WC 1725)
4. Trial Transfers of Water (WC 1735)
5. Long Term Transfer of Water (WC 1737)

As examples of temporary urgency petitions to change the place of use, the SWRCB authorized delivery of water to Grasslands Water District in 1986 and to Kern National Wildlife Refuge in 1987 for wildlife purposes.

Retirement of Cropland for Added Water Supply

In some areas, farmers may be willing to sell the water otherwise used for their crops. This would only provide transferable supply in surface water delivery areas where the reduction in use would add to surface water supply. Generally, the amount made available would be the evapotranspiration of the crop (the difference between diversion and return flow and deep percolation).
In 1977, under the Federal Emergency Drought Act (the Act), the U.S. Bureau of Reclamation purchased 46,440 AF of water at prices ranging from $15 to $87 per AF. The average was about $53/AF. Some 3,900 AF was deducted as an allowance for lost reuse of return flow and wheeling losses. Thus about 42,500 AF was sold to 26 different contractors at an average price of $61 per AF. About 25,500 AF was used to maintain high-value perennial crops and the remaining 21,000 AF was used to support foundation dairy and beef cattle herds, breeding stock and other approved uses.

Most of the supply for the federal programs was from Sacramento Valley irrigators who left rice acreage unplanted; although about 8,000 AF came from the State Water Project out of the water relinquished by SWP Southern California Contractors as part of State system exchanges. Most of the water sold was for use on the west side of the San Joaquin Valley by fe4eral contractors.

The program was entirely voluntary and no pressure was extended by the government to promote the program. The USBR, as a water broker, bought water from growers and districts which did not need it and sold it to other consumers who faced severe economic losses due to the drought. Little adverse public reaction was noted. The Act allowed the USBR to negotiate water prices but required that there be no undue benefit or profit to the seller. In addition to paying a price sufficient to compensate growers for not growing a crop. (or reducing acreage), an additional sum was paid to compensate other landowners In the service area for added costs incurred because their customary supply from return flow was cut off.

Financial assistance was available for purchase of water through interest-free loans with up to 5 years to repay. Eighteen of the 26 California Central Valley Project contractors who purchased water under the program opted for the interest-free emergency loans. The loans totaled approximately $2.0 million out of $2.6 million total sales revenue.

In 1991 the Department of Water Resources established a water bank to provide source of water to meet critical needs (e.g., health and safety, fire fighting, maintaining baseline populations of fish, carry over storage for next year). Water is being purchased from willing sellers.

Reducing Nonessential Uses

Using water in ways it is most needed represents an effective form of supply augmentation. The following lists possible sources of diverted water.

Reduce Power Generation

During the 1987 dry year, the San Francisco Water Department maximized reservoir levels by cutting back on hydroelectric power production. Although it cost $30 million in lost power revenues, this action saved the department 360,000 acre-feet of water (at $83.33/acre-feet).

Limit Aquifer Recharge Programs

During dry periods, aquifer recharge programs (or “ground water banking") should be suspended and previously “banked" ground water withdrawn to augment the system's supplies.

Eliminate Recreational Boating

Reservoirs used for recreational boating can be emptied to water levels below boat ramps. Boating should be curtailed until the reservoir refills to an adequate level.

Exploit Unused Surface Water Supplies

These supplies are generally used only in more extreme drought stages because of aesthetic or economic criteria. Sources to consider include large recreational and golf course ponds. Also, dead reservoir storage (water below the out-take) level can be used. This water can be obtained by installing alternate piping and pumping facilities.

Increase Use of Reclaimed Water

Depending on health and safety considerations, treated wastewater can be used to irrigate golf courses and other large turf areas. During the most serious stage of the 1984 Texas drought, recycled wastewater was the only permissible water for lawn irrigation in Corpus Christi. With the uncertainties of drought, examination of, opportunities for new wastewater reclamation projects is always an appropriate part of drought contingency planning.

In order to facilitate future use of reclaimed water, agencies may consider requiring new construction to be double plumbed to use reclaimed water whenever reclaimed water meeting all health standards for the use is currently available or where it will be available in the reasonable future.

Use of Gray Water

Use of gray water may allow a purveyor's customers to save millions of dollars worth of mature trees and shrubs. The California Department of Health Services provides guidance for the safe use of gray water. The DHS guidelines are reproduced in are available through the DHS office.

During 1989 Santa Barbara County amended the Building Code Ordinance to allow the use of gray water and in 1990 the County of San Luis Obispo adopted similar regulations. For gray water systems which require minor modifications to the wastewater pipes, these Counties require a $30 Building Permit be issued.

Investigate Blending Poor Quality Water with Good Quality to Stretch Supplies

Although too saline for irrigation, brackish water with TDS (salt) levels above 1,500 ppm may help stretch supplies in certain locations. This water can be blended with high quality water to extend usable quantities. Sometimes poor quality drainage water can be recycled back to the field water supply ditch. Doing so would have minimal long-term consequences on once- through systems where return flow and deep percolation is lost from the fresh water system anyway. Where return flow is reused and where soil salinity is a problem, the use of a partially brackish supply may not be advisable. Growers need to be careful in use of brackish supply; the wrong chemical constituents can also ruin soil permeability and future water uptake. The advice of local experts should be sought before extensive applications. Also, remember that the quality of major system canal supplies from the Delta will probably be worse during very dry periods.

In some cases municipal supply could be stretched by blending in well supplies of marginal quality. One or two bad constituents can be reduced to acceptable levels in the blend.

Weather Modification

Weather modification is widely practiced in California higher mountain watersheds, especially in the southern Sierra and on the Central Coast. Favorable cloud seeding opportunities tend to be less in critically dry years because of the lack of storm systems, but the seedable fraction is probably about the same. A 1986 consultant's report by North American Weather Consultants for DWR on the Feather River basin indicated a potential for about 50,000 AF more runoff in 1977 if a full-scale project had been operating then. That amount is about 10 percent of the drought-reduced 1977 runoff from the proposed target area. While cloudseeding has proven very effective in some areas of the state, it should be noted that such programs can only produce results if there are storms to seed. During a drought, there would likely be very little benefit from cloudseeding.

Some benefits could be achieved from a crash program of cloud seeding in unseeded watersheds. However, amounts would likely be considerably les than from a well-designed program of aerial and ground seeding. Water managers who have storage facilities on mountain watersheds probably should give weather modification serious consideration and carry out some advance planning for future years. Where potential cloud seeding projects have had considerable past study or have operated in the past a properly directed aerial cloud seeding program may be able to quickly augment precipitation and runoff to some extent.

Emergency Supplies

For those communities, which are very short of water, emergency supplies may be needed. Although inconvenient, hauling water is a simple expedient for individual residences or small

communities. Hauling costs are nominal if distances are short, but can be high if long distances and large quantities of water are involved. Hauling facilities can vary from small containers in the family car to large tank trucks or railroad tank cars. Public health considerations require care in selection of hauling vessels. Tank trucks or containers which have been used for toxic materials must not be considered, since it is almost impossible to remove all traces of these materials from containers.

It is interesting to note that, during 1977, several communities with severe water rationing were able to get by with 35 to 50 gallons per capita per day of average residential supply. Goleta's 1989-90 water use averaged 67 gpcd at single family accounts and 49 gpcd at multi-family accounts.

Larger communities may find temporary pipelines practical. Even irrigation sprinkler pipe may work if a suitable source can be found. The State Office of Emergency Services (OES) can provide some assistance. In some areas there are also commercial irrigation suppliers, such as “Rain for Rent” that can provide additional water when needed. Contact the nearest regional office of the OES for information.

PART C

SUPPLEMENTAL INFORMATION; DEMAND REDUCTION METHODS

Supplemental Information on Demand Reduction Methods

Demand reduction methods range from voluntary to mandatory. The following section describes drought measures undertaken in response to droughts in California, Texas, Connecticut, and Virginia. In addition, drought demand reduction methods are presented as taken from drought contingency plans prepared for South Florida; Pennsylvania; and Seattle, Washington.

Increase Efficiency

Actions to make a utility's operating system more efficient save water and set a good example for the public. A utility should take actions itself to conserve water before it can ask its customers to do the same.

System water audits can identify major water losses. For example, the average unaccounted-for water in California cities is about 9.5 percent. Once system losses are determined, the next step is to conduct a leak detection and repair program for large leaks. Detailed information on these procedures is contained in the Department of Water Resources (DWR) publication Water Audit and Leak Detection Guidebook. When appropriate, water theft prevention programs should be implemented. These programs save water and have high visibility, thus they complement the public education programs.

A utility can reduce water main flushing to the extent permissible by health and fire standards, recycle water used to backwash filters, and flush existing wells to develop the maximum flow possible.

Voluntary Measures

Voluntary measures are normally effective only when the public is convinced that a severe water shortage or drought exists. This can be accomplished by letting the public know how many days of supply remains, or showing them pictures of near-empty reservoirs. These types of photographs were successfully employed in Santa Barbara during 1990 to urge the public to save water. Commonly encouraged conservation actions for various customer types are summarized in this section.

<u>Residential Customers</u>
Public information campaigns are the most common conservation measures, yet success is not guaranteed since they require a voluntary alteration of peoples' water use habits. The benefits of public information campaigns are that they can be implemented quickly at no direct cost to the customer; they also help the public to appreciate the severity of the water shortage.

Examination of water reductions in Goleta during the current drought shows that when the public perceives the drought to be severe behavioral changes (such as flushing the toilet less often) can be achieved.

Structural changes can also yield considerable savings. For example, one private college dormitory near Santa Barbara installed 350 ULF toilets for 1400 students and had immediate water savings of 30 percent. Providing ULF toilet rebates, free 2.0-gallon showerheads, gray water information and home water audits can reduce residential use by up to 50 gpcd without significant lifestyle changes.

Water districts should mount aggressive public information campaigns during droughts. Savings from this measure alone ranged from 5 to 20 percent, depending upon the time, money, and effort spent. Good water-use habits should be communicated to the public. The DWR publication *Designing a Public Information Program for Water Conservation* can also be used as a resource.

Water Purveyors and Other Agencies

To win the public's cooperation, water purveyors and municipal agencies must demonstrate a visible commitment to efficient water use.

Business and Industrial Users

Utilities should also encourage business and industrial water conservation. The California Department of Water Resources has prepared industry specific “tip sheets” showing numerous ways businesses can conserve water. Individual flyers are available for restaurants, health care facilities, schools and colleges, food processing industries, beverage industries, golf courses, hotels, and laundries and linen suppliers. The combined savings from the listed actions, along with reduced irrigation, are generally between 15 and 25 percent of business and industrial users' pre-drought demands.

Fixture Replacement Programs

Water utilities should establish or expand existing toilet and showerhead replacement campaigns. While replacement is normally performed for long-term conservation, it can be implemented quickly if enough financial and human resources are allocated.

Older homes without such water-conserving devices use an average of 23 gallons per capita per day (gpcd) more inside the home than a newer, water-efficient home (i.e., 77 gpcd vs. 54 gpcd, respectively). A replacement campaign reduces consumption in these less efficient homes by providing efficient showerheads, dye tablets to indicate leaky toilets and offering ULF toilet rebates. Low-flow showerheads save an estimated 7 gpcd, ULF toilets save 16 gpcd.
Replacement campaigns vary in cost and effectiveness depending upon the promotional advertising, size of rebate, showerhead selected, and installation method. These campaigns can be divided into the three types discussed below depending upon the installation method.

Depot Distribution

This is the least expensive program and one that may not save water fast enough during a Stage lor II program. This is because most customers will not have the motivation to come to a depot. However, Stage III and IV (mandatory rationing) programs result in highly motivated customers and depot distribution is very effective. During 1989, the Goleta Water District distributed more than 35,000 showerheads (serving a. population of 74,000) and 34,000 were picked up at a depot.

The installation rate for those who picked up the kits was at least 90 percent, verified by on-site inspections.

Mass Mailing

Retrofit kits and accompanying installation instructions are mailed to every dwelling unit and business address. During non-drought periods this method yields a greater number of installed kits than does a depot distribution program, but the costs are higher due to postage costs and the larger number of kits distributed.

Door-to-Door Campaigns

These programs yield very high installation rates because distributors can offer free installation. Although expensive, this is the preferable distribution method during non-drought periods because it results in an excellent installation rate - approximately 80 percent. Programs in San Jose, California and Phoenix, Arizona reported 89 and 93 percent installation rates, respectively.

In the past, water conservation kits often included shower flow restrictors and toilet tank displacement bags. Restrictors have been shown to be very unsatisfactory to customers and they should not be used. A high quality showerhead will save far more water and will not cause an anti-conservation backlash among customers. Displacement devices such as bags, bottles, or dams are only temporary measures. If an agency can finance rebates for toilet replacement with ULF models, the water savings will be far greater and will be permanent.

System Pressure Reduction

Utilities can reduce system pressure to the extent permissible by fire-fighting standards. Comparison of water use records of two similar Denver neighborhoods indicated that homes with low water pressure utilize an average of 6 percent less water than do homes with high water pressure.

The South Florida Water Management District Water Shortage Plan requires system pressure reductions when there is even a moderate water shortage. Water authorities are asked to reduce pressure to 45 psi at the point of use (i.e., the meter). The utility then notifies local fire departments to make arrangements to restore pressure quickly in case of fire.

Pressure reduction should not be used as a conservation measure during Stage I or Stage II programs because reduced pressure may cause irrigation systems to function poorly.

Rebates and Incentives

Utilities can provide rebates for water-conserving devices. Issuing rebates to customers who install water conserving devices demonstrates a serious commitment to water conservation by the utility.

Many water agencies offer incentives for low water use landscaping as part of their ongoing conservation programs. Care should be taken when offering landscape rebates or connection fee discounts for low water use landscaping since severe drought may subsequently require the

prohibition of irrigation except with gray water. These incentives should not be offered in any year when irrigation might be prohibited.

Water Pricing Strategies

Utilities can implement new water pricing structures. Water use reductions in metered areas can result from raising basic rates or varying use charges with respect to water consumption levels. Such increased costs often provide an economic incentive for customers to reduce water use. All such water rate structures should be devised to enable the utility to recover the procurement, treatment, and transfer costs of the water it provides.

Whenever price structure changes are contemplated for use as part of a drought management plan, a realistic assessment of the time and effort to complete the approval process must be made. Often, the utility rate setting process takes several months. However, an agency can expect rapid and significant water savings resulting from large price increases combined with punitive excess use rates.

Inclining Block Rate

The billing rate increases as water use increases under an inclining block rate structure. This method encourages customers to save water and frugal water users will benefit from lowered rates.

During severe droughts the steps between blocks should be very steep to strongly discourage excess use. In 1987, the Goleta Water District replaced its two tier block rate structure with a four tier inclining block rate structure. Tier four is $2.25 per hundred cubic feet (HCF'). During rationing this rate structure is accompanied by an excess-use charge of four times the highest tier ($9 per HCF) for customers who exceeded their allotment.
Any such pricing system should include a lifeline rate that is as low as possible for basic sanitary uses.

Uniform Rate

A common unit price is charged all accounts under a uniform rate structure. While this method provides some incentive to reduce consumption compared to a declining block rate structure, as; increased water use is directly tied to increased costs, it represents a passive rate structure which is not likely to reduce water sufficiently during a drought.

Seasonal Rates

For seasonal rates, 1ow water charges cover the water production costs in winter; in summer, or other peak periods, the rates increase to meet the capital costs associated with the expanded facilities necessary to produce peak demand capacity . These increased summer rates influence customers to reduce water use to lower their costly summer water bills. The Los Angeles Department of Water and Power has a seasonal rate structure.

Drought Surcharge

During extreme water shortages, water utilities often institute surcharges to alleviate falling revenues due to decreased water sales. It should be made clear that these surcharges are separate from normal billing, and will be eliminated when the drought is less severe.

Excess-Use Charges

This water fee is assessed during rationing periods to those customers exceeding their allotments. During the serious 1984 Texas drought, Corpus Christi officials implemented stiff excess use charges: $3.00 for the first 1,000 gallons over the allotment; $5.00 for the next 1,000 gallons: $10.00 for the next 1,000 gallons; and, finally, $25 for each additional 1,000 gallons.

Unmetered Areas

Unmetered areas face special challenges implementing drought conservation programs because they cannot impose percentage reductions or per capita allotments. Conservation programs must consist of voluntary measures, informational programs, rebates and incentives, technical assistance, and specific prohibitions.

Mandatory Measures

Mandatory compliance measures are more severe than voluntary measures, produce greater water savings, and are less costly to the utility .The principal drawback to these measures is the resentment they may cause in customers if the measures are not seen as equitable. Therefore, mandatory measures should be well designed and accompanied by a good public relations campaign. Customers need to be convinced that their sacrifices are warranted. They need to see that the water utility is achieving a balance between demand and available supply.

Ordinances

Ordinances banning specific uses of water are forms of mandatory measures and can be divided into the following groups.

Ordinances Making Water Waste Illegal
Wording for this type of ordinance will vary; for example, an ordinance introduced in Antioch, California during the 1977 drought, reads as follows:

"Section 2. Waste of Water Prohibited.

No water furnished by the City shall be wasted. All water withdrawn from the city's facilities shall be put to reasonable beneficial use. Waste of water includes, but is not limited to, the following:

- Permitting water to flow on the sidewalks, driveways, or streets or escape down a gutter, ditch or other surface drain.
- Excessive irrigation of landscaped areas.
- Failure to repair a controllable leak of water."

Ordinances Controlling Outdoor Watering.

Such ordinances can have various stipulations:

1. Watering only between certain hours or on specific days: During 1988 the City of San Luis Obispo limited landscape irrigation to every other day and water use increased. Odd/ even or thrice weekly watering limitations often result in increased water use because they encourage customers to irrigate when they otherwise might not. Twice weekly is recommended if irrigation is allowed. The Water Shortage Plan for the City of Santa Barbara demonstrates how outdoor residential watering restrictions can be made more severe as a drought situation progresses. During Stage I and II (minimum water shortage), existing residential landscaping could only be irrigated before 8 a.m. and after 5 p.m. During Stage III (severe water shortage) the use of sprinklers was banned and regulations allowed only drip irrigation.

2. Watering only with hand-held hose or container: In March 1990, the City of Santa Barbara instituted a sprinkler ban whereby residential customers could only utilize drip irrigation. Sprinkler bans can create considerable public resentment because of the great inconveniences they cause. Fixed allocations. allowing customers to responsibly use the water they are allocated as they see fit, allow the water purveyor to avoid unpopular water use bans until Stage IV. For example, the North Marin County Water District (NMCWD) greatly exceeded their rationing goal of 30 percent with their sprinkler ban. The NMCWD subsequently changed its plan to a voluntary percentage reduction program. A rationing level of 30 percent was achieved through that modification, eliminating most of the turf damage that would have occurred if the sprinkler ban had been continued.

3. Watering only with recycled water: Lawn watering was prohibited in Corpus Christi, Texas on August 25, 1984, as a result of the serious drought. The city implemented a program to use reclaimed water for landscape irrigation and construction uses. Licensed, private tank truck companies delivered reclaimed water to business and residential customers. Before implementing this program, the public health aspects were addressed by the local public health agency. Regulations stipulated that a minimum 1 part per million chlorine residual be maintained to all applied reclaimed water. This reclamation program was judged to be very successful both for reducing landscaping losses and for maintaining jobs and income of severely affected nursery and landscape businesses. This program provided an estimated 7 million gallons of reclaimed water for residential and business landscaping throughout the City during the months of August through October 1984.

4. Watering Only with Gray Water: During 1989 Santa Barbara County amended the Building Code Ordinance to allow the use of gray water and in 1990 the County of San Luis Obispo adopted similar regulations. Most residences produce 20 to 40 gallons of gray water per person each day. The per capita gray water produced at a residence is enough to provide all the water needs of four mature fruit trees or a dozen shrubs. The gray water is distributed through irrigation hose to subsurface irrigation points.

Ordinances Restricting Non-irrigation Outdoor Water Uses

During the most serious stage of the Stamford, Connecticut, 1980-81 drought, water authorities instituted various prohibitions on outdoor water use, such as:

1. Window washing only by professionals who use buckets smaller than 3 gallons.
2. Car washing only in commercial establishments which use recycled water.
3. No filling or draining and refilling of swimming pools, lakes, or ponds unless directed by the water authority.
4. Air conditioning, systems not allowed unless they are recirculating systems.
5. Using water for the washing or cleaning of industrial or business equipment prohibited unless specifically authorized by the Health Department.
6. Cleaning the inside or outside of buildings with water prohibited.

Prohibitions on new connections or the incorporation of new areas

Rationed water users often demand prohibitions restricting the addition of new water connections during a severe drought. For example, during the 1980-81 drought, the City of Virginia Beach, Virginia, initially found it difficult to obtain well water from neighboring communities. These communities had questioned Virginia Beach's true need for extra water, as the City had been continuing to permit new hookups to the City's water supply during the drought. Similarly, water customers, who are called upon to make sacrifices during a drought period, often feel that water agencies should concentrate upon fulfilling present obligations rather than accepting new responsibilities.

Another way to deal equitably with the new connection issue that can be especially effective in droughts is to enact an offset program. Under this program developers wanting approval for new construction demonstrate that they will conserve at least as much water in 1he existing community as their new project will use. This program is underway in several communities already. Developers have "the option to carry out the conservation themselves or they can contribute a specified amount into the water agency's conservation fund. These funds can then be used to finance conservation improvements in public facilities and low-income housing. This has the double benefit of conserving water and providing assistance to low-income residents.

It has been pointed out that just a one to one offset still puts the existing community at a disadvantage. When the project is completed there is still an increased demand on the supply. Although the developer has offset the new demand, this has been accomplished by using up some of the existing slack in the community's existing water use practices. When the next drought comes there will be less slack and the new development, which is already water efficient, will result in increased demand.

This can be compensated for by having a greater than one to one offset. The developer would fund conservation more than the amount the new project would use. This would mean that the new project would actually make the community better able to resist a drought. Santa Monica now requires a two to one offset. This same program is being considered by the City of Los Angeles.

Rationing

Rationing can be very effective reducing water consumption. Required percent reductions can be constant, stepped, or variable. Fixed percentage reductions were widely implemented during the 1977 California drought. The cities of Concord, Palo Alto, San Mateo, Napa, and Vallejo, California, all implemented allotment programs dependent upon a customer's previous year water use. In southern California, people were given a baseline allotment of 0 percent of their former year's consumption with, excess use charges for water consumption above that level. The fixed percentage system was easy to coordinate because water allocations were quickly determined from the previous year's water bill. However, the percentage reduction method was widely perceived as inequitable because it had the effect of penalizing former water conservers while rewarding those who had previously used large water quantities. Identical houses could therefore receive vastly different water allotments. This plan also did not distinguish between door and outdoor water use.

The fixed amount per capita or per household rationing method was preferred by San Francisco-area residents in an attitude survey conducted after the 1976- 77 drought. Marin County's plan with per capita allotments was judged the most equitable because it also banned outside irrigation. This program achieved a 63.1 percent reduction compared to 1975 (pre-drought) consumption patterns. Apartment dwellers cut back their water use by an average of 45 percent and single-family homes reduced water use 75 percent.

The Goleta Water District's rationing plan, Stage III, established a hybrid fixed per capita and percentage reduction for residential accounts. Each residential account received a life-line allocation (11 HCF/month single family, 7 HCF/Month multi-residential unit) and a percentage of their average use. Reductions ranged from 0% for the most conservative users to 45% for the largest users. If the water shortage increases the percentage add-on can be reduced or eliminated. Residential allocations were increased for additional residents, health related problems and fruit trees, but only if ULF toilets, 2.0 gpm showerheads and drip irrigation were installed at the account. Commercial and agricultural accounts were reduced by a percentage from their 1984-88 average.

Reduction achieved through rationing from the 1977 California drought ranged from 10 percent to 60 percent. During the 1986-1992 drought the City of Santa Barbara reduced water use by 35 percent and the City of San Luis Obispo set a goal of a 50 percent reduction.

DROUGHT TIPS

Conservation Actions for Business and Industrial Users

- Start a water conservation program
- Assign water usage monitors
- Read the water meter weekly to determine the effect of water conservation measures
- Install ultra-low flush toilets and low flow showerheads in employee/customer restrooms
- Adjust water flows in industrial processes to save water and energy
- Turn off water to rooms and building areas not in use
- Install recycling systems for chilling and cooling towers
- Use ponded water supplies when appropriate
- Discontinue continuous flow processes when possible
- Wash windows only when dirty, not on a regular basis
- Instruct cleaning crews to be frugal with water
- Provide paper cups to reduce water use at water fountains
- Replace worn-out water-using appliances with newer, more efficient models
- Recycle dishwasher rinse water
- Sweep shop floors rather than hosing them down
- Reduce fresh water used for cooling and air-conditioning systems (i.e., raise office air temperature)
- Use treated waste water for landscape irrigation when possible
- Use treated waste water for industrial processes when possible
- Check water hose couplings for leaks on a weekly basis
- Ensure that solenoids and valves controlling water flows are completely closed when the water-using cycle of a machine is not engaged
- Adjust flushometers and automatic flush valves to utilize the minimum amount of water necessary
- Check for and repair leaks

Conservation Actions for Residential Customers

Indoors:

- Repair leaking faucets and running toilets
- Do not use toilet as a wastebasket
- Install low-flow showerheads and put aerators on sink faucets
- Turn off the tap while brushing teeth, shaving, preparing food, etc.
- Wash only full loads in the washing machine or dishwasher
- Replace older, high water-using toilets with newer, ultra low-consumption
- Take shorter showers or shallower baths; collect water with a bucket while waiting for the shower water to heat up and use it later for watering indoor plants
- Use low-sudsing detergents to minimize amount of rinsing water needed
- Use garbage disposal sparingly
- Insulate water heaters and hot water pipes reduce wasted water while waiting for hot water
- When washing dishes by hand, fill a rinse water pan instead of allowing water to run
- Adjust all water-using appliances to use the minimum amount of water/energy necessary

- ❖ Keep a bottle of drinking water in the refrigerator; this saves running the tap to get cooler water
- ❖ Sweep driveways and sidewalks instead of watering them down to clean them

Outdoors:

- ❖ Position sprinklers carefully to avoid watering adjacent paved areas
- ❖ Water in the evening or early in the day when evaporation rates are lower and wind is minimal
- ❖ Follow landscape irrigation guidelines to water plants only when necessary
- ❖ Don't mow lawns too short; taller grass retains moisture better
- ❖ Surround plants with mulch or rocks to retain soil moisture
- ❖ Install a shut-off valve on hoses to save water while watering plants or washing the car; wash vehicles less frequently
- ❖ Direct downspouts or gutters toward shrubbery or trees
- ❖ Collect rainwater in a large bucket to use in outside areas
- ❖ Use drought-tolerant and native vegetation in outdoor landscaping
- ❖ Use a broom, not a hose, to clean driveways, steps and sidewalks.

Conservation Actions for Water Purveyors and Other Agencies

- ❖ Maintain an aggressive leak detection and repair program
- ❖ Repair leaking plumbing fixtures in public facilities
- ❖ Test and repair source and customer meters for improved water accountability
- ❖ Turn off ornamental fountains and other highly visible water luxuries
- ❖ Reduce the frequency of street washing and main flushing to minimum level necessary to maintain health and safety standards
- ❖ Cut back or eliminate fairway watering at all golf courses that receive public water; reduce watering at golf course tees and greens to minimum levels
- ❖ Prohibit restaurants and other food establishments from routinely providing water unless specifically requested by customers
- ❖ Restrict the filling or refilling of public and private swimming pools
- ❖ Cover swimming pools when not in use to reduce evaporation and heat losses
- ❖ Install automatic shut-off valves in public restrooms
- ❖ Discontinue vehicle washing except for medical or sanitary reasons (i.e., food delivery or medical vehicles)
- ❖ Ban the use of water to clean paved surfaces
- ❖ Reduce fire hydrant use by municipal road crews or contractors
- ❖ Impose fines for illegal hydrant openings
- ❖ Post water conservation notices near all water sources such as water fountains and sinks
- ❖ Install flow restrictors on hoses and faucets
- ❖ Require hotels/motels to post water conservation notices in guest rooms

Key to Choosing Demand Reduction Measures for a Drought Strategy

The following key provides a list of activities that your district may choose to implement during a water shortage, and are listed by stages. In the key you will find details regarding water demand management options – Review the options your district can use to reduce demand during the next drought. Use the following key to assess which measures are suitable for your district. These estimates are ranges of potential reduction, timing to realize savings and costs to water districts and are based on previous results of similar programs utilized in Santa Barbara County during the last drought.

IMPACT ON WATER DEMAND*:
H = High
M = Medium
L = Low

TIMING OF WATER SAVINGS REALIZED TO DISTRICT:
I = Immediate/Short-Term (Within 2 months)
M = Mid-Term (2-4 months)
L = Long-Term (Over 4 months)

COST TO DISTRICT TO IMPLEMENT:
H = High (Over $ 30 per account)
M = Medium ($ 10 - $30 per account)
L = Low (Up to $10 per account)

*The estimated impact to water demand is based on experience and observations of water district staff and reflects the relative influence of each program on total water use patterns. These impacts assume that water efficiency programs or best management practices have ***not*** been implemented. Also note that, while the impact on water demand of any one measure may be rated as "Low", the cumulative impact of implementing many measures rated "Low" will be higher.

For more information regarding water savings potential of each BMP, see the statewide Memorandum of Understanding for Urban Water Conservation (www.cuwcc.org).

Demand Reduction Measures Key

WATER CONSERVATION PROGRAM	Impact On Demand	Timing	Overall Cost To Implement
Recommended Programs for Pre-Stage 1 (Urban Water Conservation Best Management Practices from Statewide Memorandum of Understanding)			
Water Survey Programs For Single-Family Residential And Multi-Family Residential Customers	**M**	**I**	**H**
Residential Plumbing Retrofit	**L**	**L**	**L**
System Water Audits, Leak Detection And Repair	**L (If % of unaccounted for water is less than 10%)** **M (Depending on Meter Replacement Policy)**	**I**	**H (Cost to District depends on size and age of system)**
Metering With Commodity Rates For All New Connections And Retrofit Of Existing Connections	**H (If not currently metered)**	**M**	**H (If not currently metered)**
Large Landscape Conservation Programs And Incentives (applies only to non-residential accounts with large landscaped areas)	**H**	**L**	**H (Only applies to some customers)**
High-Efficiency Washing Machine Rebate Programs	**M**	**M**	**H**
Public Information Programs	**M**	**I-L Depends on Message/Program**	**M**
School Education Programs	**L**	**L**	**L**
Conservation Programs For Commercial, Industrial, And Institutional (CII) Accounts	**L (Less than 20% CII)** **M (In areas with at least 30% C&I Use)**	**M**	**H (High cost applies only to accounts that request surveys)**

Wholesale Agency Assistance Programs	**L**	**L**	**NA**
Conservation Pricing	**M**	**M (Depends on the billing cycle)**	**L**
Conservation Coordinator	**M**	**L**	**L**
Water Waste Prohibition	**L**	**M**	**L**
Residential Ultra Low Flow Toilet Replacement Programs	**M**	**M**	**L**
Recommended Actions For Drought Stage 1 - Minimal (Up to 15% Reduction)	**Impact On Demand**	**Timing**	**Overall Cost To Implement**
Implement all applicable pre-stage 1 measures	**-**	**-**	**-**
Provide technical assistance to customers	**L**	**M**	**L-M**
Begin public information campaign– drought message	**M**	**I-M**	**L**
Ask customers for voluntary reductions in use	**M**	**M**	**L**
Provide incentives to customers to reduce water consumption (rebates, free devices)	**M**	**M**	**H**
Prohibit wasteful use of water	**L**	**M**	**L**
Recommended Actions For Drought Stage 2 - Moderate (15 – 25% Reduction)	**Impact On Demand**	**Timing**	**Overall Cost To Implement**
Limit number of building permits issued	**L**	**-**	**L**
Implement water shortage rate structure (Change the water rate structure from a uniform rate to an inclining block rate)	**H**	**M**	**L**
Plumbing fixture replacement	**H**	**M**	**L**
Request increased reduction by customers (higher percentage than Stage 2)	**M-H**	**I**	**L**
Require that eating establishments serve water only when specifically requested by customers	**L**	**I**	**L**
Prohibit use of running water for cleaning hard surfaces such as sidewalks, driveways, and parking	**L**	**I**	**L**
Require lodging hotels/motels to post notice of drought condition with tips in each guest room	**L**	**I**	**L**
Provide weekly updates on supply conditions to media and public	**L**	**I**	**L**
Recommended Actions For Drought Stage 3 - Severe (25-35% Reduction)	**Impact On Demand**	**Timing**	**Overall Cost To Implement**
Prohibit some uses of water – i.e., lawn watering using sprinklers	**H**	**I**	**L**
Institute rationing programs through fixed allotments			

or percentage cutbacks	**H**	**I**	**L**
Reduce pressure in water lines	**L**	**I**	**L**
Prohibit use of ornamental fountains and ponds, except when water is re-circulated (include a sign adjacent to the fountain stating that the water in the fountain is being re-circulated)	**L**	**I**	**L**
Prohibit filling swimming pools and spas unless the pool or spa is equipped with a pool cover	**L**	**I**	**L**
Prohibit the use of potable water for cleaning, irrigation and construction purposes, including but not limited to dust control, settling of backfill, flushing of plumbing lines, and washing of equipment, buildings and vehicles	**L**	**I**	**L**
Vehicles and boats can only be washed at a car wash that recycles water or uses 10 gallons or less of water per cycle or with a bucket and hose equipped with a automatic shut-off nozzle	**L**	**I**	**L**
Recommended Actions For Drought Stage 4 - Critical (35-50% Reduction)	**Impact On Demand**	**Timing**	**Overall Cost To Implement**
Intensify implementation of all measures in previous stages	**-**	**-**	**-**
Implement mandatory water rationing including per-capita water use allocations for residential customers	**H**	**I**	**M (Enforcement)**
Restrict water use only to priority uses (no lawn watering, car washing)	**H**	**I**	**M (Enforcement)**

SECTION 2

RESOURCES FOR DEVELOPING RATIONING AND ALLOCATION PROGRAMS AND RATES

PART A

IMPLEMENTING A RATIONING PLAN

IMPLEMENTING A RATIONING PLAN

How to Implement a Rationing Plan:

Deciding how to allocate water to customer classes and to individual services is one of the more difficult tasks facing water managers in times of drought. It should be worked out in advance because there may not be adequate time to develop a fair and equitable system once the crisis is at hand. Furthermore, it can take substantial lead-time to develop necessary information, printed materials, and computer programming support.

- One method of rationing establishes a plan with per capita allotments for residential services and using percentages of a set water budget for other customer classes. (However, this does require collecting information on the populations of every residential service).
- Another option for rationing provides defined allocations to each customer class as demonstrated below.

  Single Family Residences receive a basic allocation (example: 22 hcf) per billing period, six billing periods per year. Then the average historic use is determined (based on 5 previous normal years). The amount beyond the basic allocation is reduced by 45% and added to the basic allocation.

  Multi-residential accounts receive a basic allocation (example: 14 hcf) per unit per billing period, six billing periods per year, for a total of 84 hcf per unit, per year. The average historic use beyond the basic allocation is reduced by 60% and added to the basic allocation.

  Commercial, Agricultural, and Recreational accounts receive a percentage (example) 85% of their average historic water use (based on 5 previous normal years), or, if there has been a change of use during the past five years, an adjusted amount appropriate to the current use of the property.

  In all cases, the seasonal water use pattern for each account is used to determine the seasonal adjustment for each account. (i.e. summer billing periods will have a higher allocation than winter billing periods in most cases) Adding the adjustment for historic usage is designed to account for extra people, fruit trees, swimming pools, and other lifestyle variations.

  Allocations for non-agricultural accounts could be no less than the basic allocation and no greater than the previous year's usage.

Penalties: For the first two billing periods in which the account exceeds that allocation, the water use beyond the allotment is billed at four times the highest water rate paid by that account. (Tiered water

rates were in effect when rationing was initiated.) The third, and all subsequent bills which exceed the allocation will have excessive water use billed at ten times the highest rate.

PART B

CUSTOMER ALLOTMENT EXAMPLE

CUSTOMER ALLOTMENT EXAMPLE

This example demonstrates how an allotment program works and can be used as a guide for developing a program for your district. If your district does develop an allotment program, the allotments and procedures should be adopted as part of your Drought Management Plan.

Customer Allotments and Appeal Procedure

Stage 1
Minimal shortage up to 15 percent
Voluntary Program

The Water District shall:

- Notify all customers of the water shortage
- Mail information to every customer explaining the importance of significant water use reductions
- Provide technical information to customers on ways to improve efficiency
- Conduct media campaign to remind consumers of the need to save water
- Publicize and expand the toilet rebate, showerhead and other efficiency programs.
- Request agricultural customers to delay planting new permanent crops

Stage 2
Moderate 15 to 25 percent shortage
Mandatory Program

In addition to the actions listed in Stage 1, the District shall establish mandatory annual allotments for each connection based on the average use during a five year base period selected by the (Water Shortage Team).

1. Each single family residential connection shall receive no more than 132 (HCF) per year (11 HCF per month) plus 40 percent of the average annual usage in excess of 132 HCF.
2. Each multifamily residential unit shall receive no more than 84 HCF year (7 HCF per month) plus 40% of the average annual usage in excess of 84 HCF .
3. Each commercial, industrial and Institutional connection shall receive no more than 81% of the average annual usage.
4. Each landscape connection shall receive 40% of the average annual usage. Each account determined by City staff to meet the City's Landscape Guidelines for xeriscape design, irrigation and maintenance shall receive 80% of the average annual usage.
5. Each agricultural "permanent crop" connection shall be allocated between 75% and 85% of the average annual usage, depending on the efficiency3 of irrigation water use. Each customer shall provide the Water Department Manager a irrigation efficiency

report including type, age, acreage and irrigation system specifics for each crop. Customers not submitting reports will receive the minimum 75% allotment.

6. Each agricultural "annual crop" or recreational connection shall be allotted between 60 and 70 percent of the average usage, depending on the efficiency3 of the water use. Each customer shall provide the Water Department Manager an irrigation efficiency report including type, age, acreage and irrigation system specifics for each crop or plant type. Customers not submitting reports receive the minimum 60 percent allotment.
7. No building permits will be issued or meters installed for new accounts which had not received building permits before the water shortage emergency declaration.

Stage 3
Severe 25 to 35 percent shortage
Mandatory Program

In addition to the actions listed in Stage 1, the City shall establish mandatory annual allotments for each connection based on the average use during a five-year base period selected by the Water Shortage Team.

1. Each single family residential connection shall receive no more than 132 (HCF) per year (11 HCF per month) plus 20% of the average annual usage in excess of 132 HCF.
2. Each multifamily residential unit shall receive no more than 84 HCF year (7 HCF per month) plus 20% of the average annual usage in excess of 84 HCF.
3. Each commercial, industrial and Institutional connection shall receive no more than 73% of the average annual usage. Agricultural efficiency is determined by comparing the water demand per crop (i.e., type, age and number of trees, soil type, geography, evapotranspiration, etc.) with the water use for that crop. Farmers determined to be under-irrigating receive the smallest reduction possible in that rationing stage and those over-irrigating receive the largest reduction for that rationing stage.
4. Each landscaping connection shall receive 20% of the average annual usage. Each account determined by City staff to meet the City's Landscape Guidelines for xeriscape design, irrigation and maintenance shall receive 70% of the average annual usage.
5. Each agricultural "permanent crop" connection shall be allocated between 73% and 83% of the average annual usage, depending on the efficiency3 of irrigation water use. Each customer shall provide the Water Department Manager an irrigation efficiency report including type, age, acreage and irrigation system specifics for each crop. Customers not submitting reports will receive the minimum 70% allotment.
6. Each agricultural "annual crop" or recreational connection shall be allotted between 20 and 30 percent of the average usage, depending on the efficiency3 of the water use. Each customer shall provide the Water Department Manager an irrigation efficiency report including type, age, acreage and irrigation system specifics for each crop or plant type. Customers not submitting reports receive the minimum 20 percent allotment.
7. No building permits will be issued or meters installed for new accounts, which had not received building permits before the water shortage emergency declaration.

Stage 4
Critical 35 to 50+ percent shortage
Mandatory Program

In addition to the actions listed in Stage 1, the City shall establish mandatory annual allotments for each connection based on the average use during a five year base period selected by the Water Shortage Team.

1. Each single family residential connection shall receive no more than 24 HCF per year (2 HCF per month) per permanent resident.
2. Each multifamily residential unit shall receive no more than 24 HCF year (2 HCF per month) per permanent resident.
3. Each commercial, industrial and institutional connection shall receive no more than 65% of the average annual usage.
4. Each landscaping connection shall receive no allotment. Each account determined by City staff to meet the City's Landscape Guidelines for xeriscape design, irrigation and maintenance shall receive 65% of the average annual usage.
5. Each agricultural "permanent crop" connection shall be allocated between 58% and 68% of the average annual usage, depending on the efficiency of irrigation water use. Each customer shall provide the Water Department Manager a irrigation efficiency report including type, age,. acreage ~~ irrigation system specifics for each crop. Customers not submitting reports will receive the minimum 65% allotment.
6. Each agricultural "annual crop" connection or recreational connection shall receive no water.
7. No building permits will be issued or meters installed for new accounts, which had not received building permits before the water shortage emergency declaration.

Appeals Procedure

1. Any person who wishes to appeal their customer classification or allotment shall do so in writing by using the forms provided by the City.
2. Appeals will be reviewed by the Rationing Manager and site visits scheduled if required.
3. A condition of approval shall be that all applicable plumbing fixtures or irrigation systems be replaced or modified for maximum water conservation.
4. Appeals may be granted for the following:
    a. Substantial medical requirements.
    b. Residential connections with more than four residents in a single family household or three residents per unit at multifamily accounts can receive 24 HCF per year per additional person. During a Stage 4 shortage, a census m be conducted to determine the actual number of residents per living unit. Water will be granted to permanent residents -defined as five days a week, nine months a year .
    c. Commercial/Industrial accounts where water supply reductions will result in unemployment or decreased production, after confirmation by a City water auditor that the account has instituted all applicable water efficiency improvements.
    d. Nonagricultural customers can appeal for 12 HCF per year per horse, cow or other large animal and six HCF per year for each efficiently irrigated mature fruit tree.

e. Government agencies (parks, schools, county, etc.) may have separate account allotments combined into one "agency" allotment.

5. In the event an appeal for additional allotment is requested for irrigation of trees or vegetation in residential categories or for any agricultural use, the City staff may use the services of a qualified consultant in determining the validity of the request.
6. The Water Shortage Team shall approve or deny appeals.
7. If the Water Shortage Team and the applicant are unable to reach accord, then the appeal shall be heard by the City Manager, who will make the final determination.
8. All appeals shall be reported monthly to the City Council as a part of the Water Supply Report.

PART C

SAMPLE RATE STABILIZATION FUND

SAMPLE RATE STABILIZATION FUND

In order to mitigate the financial impacts of a water shortage, a district can establish an emergency fund. The goal is to maintain the fund at 75% of normal annual water department revenue. This fund will be used to stabilize rates during periods of water shortage or disasters affecting the water supply. The district will not have to increase rates as much or as often during a prolonged or severe shortage. However, even with the emergency fund, rate increases will be necessary during a prolonged water shortage. As described earlier in this plan, a Stage 2 shortage requires a 20% reduction in water deliveries, while Stage 3 requires a 35% reduction. The experiences of California water purveyors during the 1986-91 drought shortage demonstrated that actual water use reductions by customers can be considerably larger than requested by the supplier. During the 1986-91 drought shortage it was also politically difficult for many agencies to adopt the rate increases necessitated by a 20 – 50% reduction in sales. When a water shortage emergency is declared, the supply shortage will trigger the appropriate rationing stage and rate increase.

Water rates increase by the following percentages when the indicated stages are implemented:

Stage 1 – no rate increase.
Stage 2 – 25% increase over pre-shortage rates.
Stage 3 – 50% increase over pre-shortage rates.
Stage 4 – 100% increase over pre-shortage rates.
End of water shortage emergency – drop back to a 15% increase over pre-shortage rates.

Most California water districts that experienced water shortages found that it required several years for customer demand (gpcd) to return to pre-shortage levels, if they ever did. Thus, in anticipation of reduced sales following a shortage, the district's rates will be set at 115% of the pre-shortage rates. Because water use is projected at 90% of pre-shortage use, the 115% increase will generate sufficient income to equal expenses. Any excess revenues collected as a result of this rate adjustment will be used to re-establish the emergency fund.

In order to mitigate the financial impacts of a water shortage, it may be helpful to establish an Emergency Fund. Your goal is to maintain the fund at 75% of normal water department revenue. This fund could be used to stabilize rates during periods of water shortage or disasters affecting the water supply. This will reduce the need for increase rates as much or as often during a prolonged or severe shortage. However, even with an emergency fund, rate increases will be necessary during a prolonged water shortage.

Water rates increase by the following percentages when the indicated Stages are implemented:
Stage I no rate increase
Stage II 25% increase over pre-shortage rates
Stage III 50% increase over pre-shortage rates
Stage IV 100% increase over pre-shortage rates
End of the Water Shortage Emergency
15% increase over pre-shortage rates (This rate increase should be re-evaluated every two years)

Most California water agencies, which experienced water shortages, have found that customer gpcd has not, nor is it expected to, return to pre-shortage levels. After a shortage, water department expenses are expected to drop below pre-shortage levels but water sales are not expected to rebound. In anticipation of reduced sales, after a declared shortage ends, the City's rates will be set for one year at 115% of the pre-shortage rates. Any excess revenues collected as a result of this rate adjustment will be used to re-establish the Rate Stabilization Fund.

PART D

SAMPLE APPROACH FOR SETTING VIOLATION PENALTIES

SAMPLE APPROACH FOR SETTING VIOLATION PENALTIES

Penalties for Violating Water Use Restriction:

a. First violation within 12 months: no surcharge.

b. Second violation within 12 months: $50.00 surcharge.

c. Third violation within 12 months: $100.00 surcharge, plus possible flow restrictor.

d. Fourth and subsequent violation within 12 months: $250.00 surcharge, plus possible flow restrictor or shut-off of service.

Drought Enforcement Officers are necessary to provide enforcement of drought regulations during the various stages of the Drought Plan. The process for implementing the penalties should be to issue a warning for the first violation, and a fine for second or third violations. In addition, it is prudent to set up an appeal process for customers who feel they are unfairly cited and fined.

SECTION 3

DROUGHT EMERGENCY DECLARATION

PART A

SAMPLE EMERGENCY DECLARATION

SAMPLE EMERGENCY DECLARATION

Resolution To Declare A Water Shortage Emergency

CITY OF NEW ALBION
NEW ALBION COUNTY, CALIFORNIA
Date

The City Council of the City of New Albion does hereby resolve as follows:

PURSUANT to California Water Code Section 350 et seq., the Council has conducted duly noticed public hearings to establish the criteria under which a water shortage emergency may be declared.

WHEREAS, the Council finds, determines and declares as follows:

(a) The City is the water purveyor for the property owners and inhabitants of New Albion;

(b) The demand for water service is not expected to lessen.

(c) When the combined total amount of water supply available to the City from all sources falls at or below the Stage II triggering levels described in the 1995 Urban Water Management Plan, the City will declare a water shortage emergency. The water supply would not be adequate to meet the ordinary demands and requirements of water consumers without depleting the City's water supply to the extent that there may be insufficient water for human consumption, sanitation, fire protection, and environmental requirements. This condition is likely to exist until precipitation and inflow dramatically increases or until water system damage resulting from a disaster are repaired and normal water service is restored.

NOW, THEREFORE, BE IT RESOLVED that the City Council of the City of New Albion hereby directs the Mayor to find, determine, declare and conclude that a water shortage emergency condition exists that threatens the adequacy of water supply, until the City's water supply is deemed adequate. After the declaration of a water shortage emergency, the Mayor is directed to determine the appropriate Rationing Stage and implement the City's Water Shortage Emergency Response.

FURTHERMORE, the Council shall periodically conduct proceedings to determine additional restrictions and regulations which may be necessary to safeguard the adequacy of the water supply for domestic, sanitation, fire protection, and environmental requirements.

SECTION 4

SAMPLE PUBLIC OUTREACH MATERIALS

PART A

HOW TO WRITE A PRESS RELEASE

HOW TO WRITE A PRESS RELEASE

General Formatting Tips

- Use 8½ x 11 (A size) paper.
- Leave wide margins for editors to write notes in. A 1 1/2" or 2" margin on each side is fine.
- You may use letter headed paper, in which case FOR IMMEDIATE RELEASE should be under the embossed information.
- Use bold to make your headline stand out.
- Stick to basic, easy-to-read, fonts. Arial or Courier is a good choice. 10 point is a good size.
- Capitalize all words in the headline, except for "a", "an", "the" and prepositions such as "to", "from" or "of".
- Leave a blank line between each paragraph, double spacing is recommended.
- Always include, at the top corner of every page, a two or three word description of the story, the name and phone number of key contact people (no more than two), the page number (if there is more than one page) and the release date (usually "for immediate release" or "please hold until XXX").
- Print on only one side of the paper.
- Leave a blank line between each paragraph. Double spacing the entire release is recommended.
- Do not split a paragraph over two pages.
- Use the --more-- centered at the bottom of each page if your press release is more than one page long. This makes it clear to reporters that another page follows.
- Keep it **short.** Maximum length should be one to two pages and no more than 500 words.
- Use short words and sentences. Make sure what you're saying is very clear. Many publications will directly reprint a press release, as long as it is written in a professional news style. Buy either the AP Stylebook or the Chicago Manual of Style, and learn the general guidelines for abbreviating words, writing numbers and capitalizing names.
- Clearly indicate the end of your press release by using three hash symbols ###.

Elements of a Press Release

Press Releases generally follow a standard format and always contain the same basic elements. Here are the main elements of a press release.

1. FOR IMMEDIATE RELEASE
   Should appear at the top left of the page, under your letter-head. Capitalize the entire phrase.

2. Your Contact Information
   Leave a blank line under "FOR IMMEDIATE RELEASE", and then list the contact name, title, telephone and fax numbers. You should also include your web site URL and e-mail address. The contact name should be someone who is capable of answering technical questions regarding the situation.

3. Your Headline
   Leave one or two blank lines, and then write your headline in a bold. Craft a headline, which conveys immediately why this news is important.

4. Dateline
   Your location (city and state) and the date of your release.

5. Lead Paragraph
   The first paragraph should grab the reader's attention, and the basic information behind your message: including the five W's (who, what, when, where, why).

6. Additional Paragraphs
   In this section you should fully explain your message and complete the story.

7. Recap
   If necessary you may recap general details about the situation at the end of your press release.

News Release

Maryland Department of the Environment
2500 Broening Highway Baltimore MD 21224

For Immediate Release

For More Information
Quentin Banks
(410)631-3003

GOVERNOR GLENDENING DECLARES DROUGHT EMERGENCY
Calls for Voluntary Water Conservation

Prompted by the most severe drought in more than 30 years, Governor Parris N. Glendening today issued an Executive Order declaring a statewide drought emergency. The Governor called upon all Marylanders to voluntarily conserve water until a newly appointed task force recommends further measures, and announced that he would seek federal financial assistance for Maryland farmers adversely affected by the drought and provide $3 million in State funds for agricultural relief.

"This drought is a serious problem. But we do not intend to let it become unmanageable," said Governor Glendening. "With water supplies severely stressed across the State, and with forecasters predicting minimal relief, it is vital that we take a coordinated, comprehensive approach to the drought on a statewide basis."

The Governor's Executive Order urges all Marylanders to take voluntary steps to immediately reduce their consumption of water and take other actions in response to the drought, including:

- Do not water your flowers or your grass;
- Do not wash your car;
- Do not wash off paved surfaces such as sidewalks or patios;
- Do not use water in ornamental fountains, waterfalls or reflecting pools;
- Refrain from outdoor burning;
- And take other common sense measures.

The Governor made the announcement on the banks of the drought-stricken Liberty Reservoir, which is owned by the City of Baltimore. The Governor pointed out that Liberty Reservoir is more than 24 feet below normal, the Pretty Boy Reservoir is down more than 18 feet, and Loch Raven Reservoir is down 5 feet.

"These three serve the Baltimore area and provide water to over 1.8 million people in greater Baltimore," said Governor Glendening. "The fact is, if water consumption continues at the current rate, there is only a 35-day supply in these reservoirs."

All across the state low rainfall has produced dangerously dry conditions. Flow in the Susquehanna River is down by two-thirds. In the Potomac River—which provides water to the Washington Metropolitan Region—flow is down by 50 percent.

Over the past three years, Maryland's precipitation has been far below normal. The cumulative impact of these conditions has resulted in farmers' crops and livestock being threatened; low water levels in several Bay tributaries, resulting in large fish-kills; and twice as many wild fires as last year. Conditions have worsened to the point where the National

Weather Service has declared that the Mid-Atlantic region is the most severely impacted part of the country.

In addition to water supply concerns, the drought is having a serious impact on Maryland's agricultural industry. The Governor's Executive Order provides for $3 million in emergency assistance for Maryland's farmers.

"The money will help provide for such aid as cover crops and hay distribution," said Governor Glendening. "In addition, I have contacted U.S. Agriculture Secretary Dan Glickman and received his assurance that he is willing to work with us to secure federal assistance for our drought-stricken farmers."

In response to the drought, the Governor appointed a Drought Emergency Coordinating Committee, chaired by Maryland Department of the Environment Secretary Jane Nishida, to develop recommendations for potential mandatory water conservation measures. The committees recommendations will be sent to the Governor by August 3.

In addition to Secretary Nishida, the task force members include: DNR Secretary Sarah Taylor-Rogers; Health and Mental Hygiene Secretary Benjamin Georges, MD; Maryland Emergency Management Director David McMillion; Agriculture Secretary Henry Virts, DVM; John Morton, Vice-President of the Mid-Atlantic Region for NationsBank; Mike Hirshfield, Vice-President of the Chesapeake Bay Foundation; and Dutch Ruppersberger, Baltimore County Executive.

"I have asked the committee to develop a phased-in, graduated series of steps we will take if drought conditions continue to worsen," said Governor Glendening. "I have seen Marylanders pull together as one community under difficult circumstances. Through blizzards, floods, and droughts, Marylanders have time and again proven that they are ready, willing, and able to do whatever is necessary."

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News Release

Maryland Department of the Environment
2500 Broening Highway Baltimore MD 21224

For Immediate Release

GOVERNOR'S PRESS OFFICE

GOVERNOR GLENDENING ENACTS MANDATORY STATEWIDE WATER USAGE RESTRICTIONS TO ADDRESS DROUGHT

Measures to Take Effect Immediately and Include Ban on Open Burning

ANNAPOLIS, MD (August 4, 1999) - - Seeking to conserve dwindling water supplies resulting from Maryland's worst drought since the 1930's, Governor Parris N. Glendening today placed mandatory restrictions on water usage throughout the State. After studying the recommendations of his Drought Emergency Coordinating Committee, Governor Glendening released an Executive Order which requires all Marylanders to limit their water use. The mandatory restrictions replace voluntary measures which the Governor had implemented last week, and take effect on a statewide basis immediately.

"This drought has devastated Maryland's water supply, drying up rivers, streams, and reservoirs," said Governor Glendening. "We must act responsibly now to contain this problem before it gets out of hand. These restrictions are simple, common sense, mandatory steps that everyone must take to help us conserve water. If each person does his or her part, we can work through this problem."

The full set of water restrictions, as well as restrictions on outside burning, are attached to this release. *(See link below.)*

"The more responsible we are today, the easier it will be for everyone in the coming weeks," said Lt. Governor Kathleen Kennedy Townsend. "We are calling upon Maryland's great tradition of shared sacrifice in times of trouble and asking our citizens to go beyond the restrictions to conserve water any way they can."

Last week, the Governor declared the first statewide drought emergency in Maryland's history. At the time, the Governor enacted voluntary restrictions, and appointed a Drought Emergency Coordinating Committee, chaired by Environmental Secretary Jane Nishida, to study the drought and make recommendations to him about implementing mandatory water conservation measures.

The Committee released its report on Tuesday, concluding that drought conditions were so dire that the Governor ought to enact mandatory measures immediately. After studying the report, the Governor released his Executive Order, which implemented the Committee's recommendations.

"Moving from voluntary to mandatory restrictions was not an arbitrary decision," Governor Glendening said. "After reviewing the Committee's report, I have determined that this drought is so severe that we cannot solve this problem by voluntary restrictions alone."

The Governor's Executive Order requires that every Marylander conserve water by eliminating nearly all outdoor water use. The measures apply to all individuals, businesses,

and governments in every jurisdiction. In addition, the measures apply to all citizens regardless of whether they use public water systems or wells.

The Executive Order authorizes local law enforcement authorities to penalize people who violate the restrictions. Penalties can range from a warning for the first offense to a maximum of a $1,000 fine.

"These are tough restrictions, but we will be reasonable and fair," the Governor said. "The Executive Order gives local authorities the discretion to grant exceptions for extreme hardship cases. And, we have set aside $250,000 in grants to help seniors and those with lower-incomes save water by buying water-conserving shower heads and repairing leaky faucets."

The Governor also announced that the State will provide comprehensive information on what people may or may not do to conserve water. For information regarding the drought, Marylanders can call the Department of Environment's toll-free hotline at 1-877-4-DROUGHT (1-877-437-6844), or check the Governor's web page at www.gov.state.md.us and clicking on drought information.

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Drought Newsletter Published by the City of Santa Barbara during 1991

SECTION 5

TECHNICAL ASSISTANCE, RESOURCES AND REFERENCES

PART A

DROUGHT PLANNING WEBSITE DIRECTORY

Drought Planning Website Directory

National Drought Mitigation Center http://enso.unl.edu/ndmc/
Western Drought Coordination Council http://enso.unl.edu/wdcc/
National Drought Policy Commission http://www.fsa.usda.gov/drought/
US EPA Office of Water/Wastewater Management http://www.epa.gov/owm/drouhome.htm
Delaware River Basin Drought Information Page http://www.state.nj.us/drbc/Dcenter1.htm
Pennsylvania Dept. of Environmental Protection Drought Information Center

http://www.dep.state.pa.us/dep/subject/hotopics/drought/drought.htm
South Carolina Drought Information Center
http://water.dnr.state.sc.us/climate/sco/drought.html
North Carolina Drought Monitoring Council http://www.ncwater.org/drought/index.htm
Texas Natural Resource Conservation Commission http://www.tnrcc.state.tx.us/index.html
NOAA's Drought Information Center http://www.drought.noaa.gov/
Texas A&M International University Drought Relief Information Center
http://www.tamiu.edu/coba/drought/
National Drought Policy Commission
http://www.fsa.usda.gov/drought/finalreport/fullreport/ndpcfullreportcovers/ndpcreportcontents.htm
National Weather Service http://www.nws.noaa.gov/

PART B

CONTACTS FOR DROUGHT ASSISTANCE AND TECHNICAL ASSISTANCE

CONTACTS FOR DROUGHT ASSISTANCE AND TECHNICAL ASSISTANCE

State and Federal Sources of Information

Many State and Federal agencies offer programs, facilities, and information during drought emergencies. In most cases, it is best to consult the telephone directory for an agency's local office phone number before calling the agency's main office.

Local offices can answer most questions and may be able to offer additional information on local conditions or local programs.

STATE AGENCIES

Office of Emergency Services

The Office of Emergency Services (OES) coordinates federal, state, and local equipment resources; maintains directories of commercial and private equipment, materials, and personnel resources for disaster relief; and provides financial assistance information. The OES also maintains a small supply of water purification units, water pumps, and generators for State and local government use.

Contact: OES Regional Offices
Region I (Los Angeles) (213) 620-5607
Region II (Pleasant Hill) (415) 646-5908
Region III (Redding) (916) 225-2680
Region IV (Sacramento) (916) 366-5341
Region V (Fresno) (209) 445-5672
Region VI (Ontario) (714) 391-4485

Department of Water Resources

The Department of Water Resources (DWR) provides many forms of water-related information and assistance, including drought assistance. During the drought
DWR is operating a Drought Center in Sacramento. This center provides all types of hydrologic information to the public and the news media, including current river flows, runoff forecasts, reservoir conditions, tide stages and tide forecasts, rainfall data, snow conditions, and weather forecasts. The Drought Center also acts as a clearinghouse to refer calls to other State and federal agencies. DWR also publishes Water Supply Outlook twice monthly. This leaflet provides current information on hydrologic conditions such as snowpack, runoff, and reservoir storage.

DWR offers man publications on water-related topics, including guidebooks for water agencies o how to carry out a variety of water conservation programs, lists of public information materials available for reproduction and distribution to water agency customers, sources of residential retrofit devices, and laws and regulations related to water conservation. DWR also offers technical assistance with urban and agricultural water conservation programs through the Water Conservation Office.

Information may be obtained from the four DWR District Offices:

DWR Central District
3251 S Street
Sacramento; California 95816- 7107
(916) 323-4891

DWR San Joaquin District
3374 E. Shields Avenue
Fresno, California 93726
209) 445-5262

DWR Northern District
P.O. Box 607
Red Bluff, California 96080
(916) 527-6530, ext. 367

DWR Southern District
P.0. Box 6598
Los Angeles, California 90055
(213) 620-4107

Information is also available by telephone:
DWR Drought Center
(916) 327-8500
(800) 272-8869

DWR Water Conservation Office
(916) 322-4587

River Flow Recording
(916) 322-3327

River Storage Reservoir Release
Delta Tide Recording
(916) 445-7571

Department of Fish and Game

The Department of Fish and Game (DFG) can provide information on wildlife conditions, habitat and protection during times of drought. Also, the DFG can provide information on water rights permits and alleviation of some conditions under Fish and Game agreements.
Contact: DFG Environmental Services Division
(916] 445-1383

Department of Food and Agriculture

The Department of Food and Agriculture (DFA) can provide information on agricultural water conservation, information on crop changes and reduction of crop acreage, and information on foodstuff location.
Contact: Local DFA offices or DFA Departmental Services
(916) 445-5141

Department of Forest and Fire Protection

The California Department of Forestry and Fire Protection (CDF) can provide information on area fire conditions, fire permits, health of plants in the area, and insect infestations.
Contact: Local or regional CDF offices or CDF general information
(916) 445-9920

Department of Health Services

The Department of Health Services (DHS) can provide information on water quality, drinking water safety, water supply, and gray water use.
Contact: Local DHS offices or DHS information
(916) 323-6111

Department of Parks and Recreation
The Department of Parks and Recreation (DPR) can provide information on State parks and recreational facilities. and conditions of reservoirs in the park system.
Contact: Local DPR units or DPR general information
(916) 445-6477

Public Utilities Commission
The Public Utilities commission (PUC) can provide information on water rationing for PUC regulated, investor-owned water utilities.
Contact: PUC Water Utilities Branch
(415) 557-1863

State Water Resources Control Board
The State Water Resources control Board (SWRCB) can provide information on changing and existing entitlements and information on obtaining emergency water appropriations.
Contact: SWRCB general information
(916) 322-4530

FEDERAL AGENCIES

Agricultural Stabilization and Conservation Service
The Agricultural Stabilization and Conservation Service (ASCS) can provide information on conservation and information on financial assistance during declared drought emergencies.
Contact: Local ASCS offices or the ASCS State Office
(916) 551-1801

U .S. Army Corps of Engineers
The Corps of Engineers (COE) can provide technical information on the services they perform.
Contact: COE Emergency Management Division
(916) 551-2539

U .S. Bureau of Land Management
The Bureau of Land Management (BLM) can provide information on recreational area conditions, water source information, campfire permits, and project burning permits.
Contact: BLM Field offices or the BLM Division of Lands and Renewal Resources
(916) 978-4725

U .S. Bureau of Reclamation
The U. S. Bureau of Reclamation (USBR) can provide information on reservoir conditions, water releases from USBR project reservoirs, and recreational area conditions.
Contact: USBR field offices or U5BR recorded message on reservoir conditions
(916) 978-5378

Farmers Home Administration

The Farmers Home Administration (FMHA) can provide information on financial assistance during declared drought emergencies.
Contact: Local FMHA offices or the FMHA State Office
(916) 666-3382

U .S. Forest Service

The U .S. Forest Service (USFS) can provide information on forest and recreation area conditions, burning permits, and campfire permits.
Contact: Nearest national forest or USFS Office of Information
(415) 705-2868

National Weather Service

The National Weather Service (NWS) can provide general meteorological information and weather forecasting.
Contact JNWS information
(916) 442-1468

Natural Resources Conservation Service (Formerly Soil Conservation Service)

The Natural Resources Conservation Service (NRCS) can provide information on water conservation and technical assistance that relates to water conservation.
Contact: Local NRCS offices.

Assistance Programs Related to the California Drought

In California, seven federal agencies and three State agencies administer financial aid programs which can provide drought financial assistance. Typically during droughts, the federal programs provide over 90 percent of the financial aid, with the State's effort oriented to technical assistance. Programs administered by two agencies of the U. S. Department of Agriculture provide the majority of the financial assistance. The Agricultural Stabilization and Conservation Service administers seven programs which can provide drought assistance. The Farmers Home Administration has 10 programs. Additionally, the U. S. Soil Conservation Service administers two drought assistance programs in cooperation with the Farmers Home Administration, the U.S. Corps of Engineers has two, and the U. S. Small Business Administration, Economic Development Administration, and the Federal Emergency Management Agency each administers one drought assistance program.

At the State level, the Department of Housing and Community Development administers two programs which can provide drought assistance and the Department of Health Services and Office of Emergency Services each have one program. The majority of financial assistance is oriented to agriculture, rural residents, and small communities. The programs provide:

- assistance to small communities to solve drought-related problems;
- emergency livestock feed assistance;
- pasture and rangeland rehabilitation cost sharing;
- emergency haying and grazing on Acreage Conservation Reserve and Conservation Use Acreage;
- soil and water conservation cost sharing
- farmland rehabilitation cost sharing;
- watershed protection cost sharing;
- mitigation for fish and wildlife losses;
- economic injury disaster loans and payments;
- drought and disaster loans to farmers for physical property damage rehabilitation costs;
- farm ownership and operating loans;
- donation of grain to Indian tribes;
- rural and small community home ownership loans
- rural rental housing loans;
- drought-related business and industrial loans for small, rural, nonfarm businesses;
- assistance to communities which could or have experienced threats to public health and welfare from contaminated drinking water; and
- assistance to communities which could or have had sudden major job losses due to a drought.

Examples of specific types of water-related drought assistance:

- developing water supplies;
- providing emergency water supplies;
- drilling and rehabilitating water wells;
- purchasing and transporting water supplies;
- installing water supply system inter-ties;

- repairing and replacing physically damaged water supply systems;
- recycling water;
- abating water pollution;
- treating water supplies;
- providing water (conservation measures; and installing drainage and waste disposal systems.

The forms of financial assistance vary by program and include loans, loan guarantees, grants, cost sharing, seed money for projects, subsidized purchases, direct construction and other direct assistance, and donations. A number of the programs also provide technical assistance.

Program information. in this appendix was accurate at the time it was obtained. However, administrative regulations, legislation, budget considerations, and drought conditions change. Each administering agency can provide its current regulations to potential applicants.

The following tabulation of the programs in this compendium can be used to rapidly review and identify the potentially applicable programs, administering organizations, and types of assistance available. More detailed information on each program is available in the DWR publication Drought .Financial Assistance Programs from the Federal and State Governments -An Update, January 1991.

Tabulation of Existing Drought Financial Assistance Programs

Federal Programs

Existing Programs	Administering Organization	Type of Assistance
Livestock Feed Program (LFP) (Feed Cost-Sharing Program)	ASCS	Cost-Sharing
Emergency Feed Assistance Program (EFAP)	ASCS	Subsidized Purchase
Emergency Haying and Grazing of Acreage Conservation Reserve (ACR) and Conservation Use (CU) Acreage	ASCS	Additional Use of Land
Conservation Reserve Program (CRP)	ASCS	Cost-Sharing
Emergency Conservation Program (ECP)	ASCS	Cost-Sharing
Agricultural Conservation Program (ACP)	ASCS	Cost-Sharing
Indian Acute Distress Donation Program	ASCS	Grain Donation
Disaster Relief and Emergency Assistance Program[1]	FEMA	Grants and Emergency Assistance
Emergency Water Supply/Drought Assistance Programs	USCE	Physical Facility Construction and Assistance
Clean Drinking Water/Contaminated Water Source Program	USCE	Supply Clean Drinking Water
Economic Injury Disaster Loan (EIDL)	SBA	Loans
Economic Adjustment (Title IX) Program (Sudden and Severe Economic Dislocation [SSED] Component)	EDA	Grants
Disaster Assistance for Rural Business Enterprises (DARBE) (Business and Industry Program)	FMHA	Loan Guarantees
Emergency Disaster Loans (EM) (Farmer Program)	FMHA	Loans

[1] May or may not cover droughts, depending on type of damage.

Federal Programs (Continued)

Existing Programs	Administering Organization	Type of Assistance
Soil and Water Loans (Farmer Program)	FMHA	Loans
Farm Ownership Loans (Farmer Program)	FMHA	Loans and Loan Guarantees
Farm Operating Loans (Farmer Program)	FMHA	Loans and Loan Guarantees
Home Ownership Loans (Housing Program)	FMHA	Loans
Rural Rental Housing Loans (Housing Program)	FMHA	Loans
Water and Waste Disposal Loans and Grants (Community Program)	FMHA	Loans and Grants
Business and Industrial Loan Program (B&I) (Business and Industry Program)	FMHA	Loan Guarantees
Resource Conservation and Development (RC&D) Loans (Community Facilities Program)	NRCS & FMHA	Loans and Development Technical Assistance
Emergency Watershed Protection Program (EWP)	NRCS	Emergency Assistance
Emergency Community Water Assistance Grants	FMHA	Grants

State Programs

Existing Programs	Administering Organization	Type of Assistance
Emergency Clean Water Grant Fund	DHS	Grants or Loans
Community Development Block Grant Program	DHCD	Grants
Rural Development Assistance Program (RDAP)	DHCD	Grants and Seed Money
Natural Disaster Assistance Act and Campbell-Torres-Cortese Natural Disaster Assistance Act Amendments of 1988[1]	OES	Cost-Sharing

[1] May or may not cover droughts depending on type of damage.

PART C

REFERENCES

REFERENCES

City of New Albion, California December 2000 Urban Water Management Plan. State of California, The Resources Agency, Department of Water Resources. December 2000.

City of New Albion, California Water Shortage Contingency Plan. State of California, The Resources Agency, Department of Water Resources. 2000

How to Reduce Drought Risk. Western Drought Coordination Council. March 1998.

Long-Term Water Conservation and Shortage Management Practices: Planning that Includes Demand Hardening. California Urban Water Agencies. June 1994.

Managing Water for Drought – National Study of Water Management During Drought. IWR Report 94-NDS-8. U.S. Army Corps of Engineers, Institute for Water Resources. September 1994.

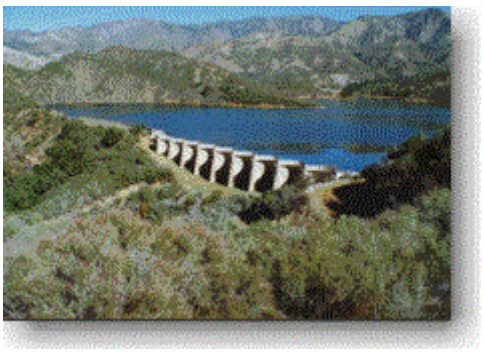
Preparing for California's Next Drought – Changes Since 1987-1992. State of California, The Resources Agency, Department of Water Resources. July 2000.

Urban Drought Guidebook – New Updated Edition. State of California, The Resources Agency, Department of Water Resources. March 1991.

SECTION 6

HISTORICAL CASE STUDY

HISTORICAL CASE STUDY



SANTA BARBARA COUNTY – SOUTH COAST

REVIEW OF 1986-92 DROUGHT

In California, between 1986-92, a prolonged drought with record-low rainfall levels had serious impacts on water users and the environment. Farmers lost or could not plant crops, forests were damaged and many trees died, urban water users were forced to conserve unprecedented amounts of water, and fisheries suffered from greatly reduced flows in rivers and lowered reservoir levels. The Central Coast region of California (Monterey, San Luis Obispo and Santa Barbara counties) was particularly hard hit by the drought.

The impact of the drought on the Central Coast was intensified by the fact that water purveyors in San Luis Obispo and Santa Barbara counties were entirely dependent on local water supplies at the time the drought occurred. Hardest hit were areas relying on local surface reservoirs, as some groundwater users were able to make up the supply deficit by increased pumping. By late 1989, the City of Santa Barbara's Gibraltar Reservoir was completely empty. Lake Cachuma, the primary regional water supply reservoir which serves several communities in the Santa Barbara area, was drawn down to only 14% of capacity by February 1991, its lowest level since the lake first filled in 1957.

In response to this critical water supply situation, several water purveyors on the South Coast of Santa Barbara County (Goleta Water District, City of Santa Barbara, Montecito Water District) adopted drought emergency measures, and water use restrictions were implemented. Together, these three entities serve approximately 180,000 people and some agricultural users. Each of these purveyors developed distinct and yet similarly effective water conservation programs. They also cooperated on innovative public education programs to reduce water demand. The experience of these three purveyors provides other water supply professionals with an example of demand reduction/drought conservation techniques.

As the drought progressed, rationing, penalty rates, and prohibition of certain water uses caused water demand to drop dramatically. Local residents faced and met the challenge of saving water with impressive results; water demand in both the Goleta and Santa Barbara service areas was approximately 40% below normal in 1990 and 1991.

In addition to conservation, some communities sought relief with expensive, and in some cases short-term, water supplies. The City of Santa Barbara, in a joint effort with several other local purveyors, commissioned

construction of a temporary desalination facility, which is now being considered as a potential long-term supply. A number of water purveyors on the South Coast also cooperated in constructing an emergency water supply pipeline to "wheel" water from the State Water Project (SWP) into southern Santa Barbara County, via Los Angeles and Ventura Counties. This project utilized local entitlements to water from the SWP, which had not been exercised up to that point in the absence of a delivery system.

Demand reduction, however, was the most significant local response to the drought. Per capita water demand fell in some months to 55% below normal. The amount of water conserved by customers was more than double the amount provided by alternative water supplies. This dramatic reduction also had a downside: a substantial reduction in anticipated revenue to the water purveyors. One challenge facing water after the drought was how to determine the long-term affects of the drought on demand (demand hardening), and to adopt appropriate water rate structures, which will balance water demands with operational costs. Water rates after the drought included the cost of new water supplies developed to provide a buffer against future droughts, such as the State Water Project and desalination.

TABLE 1: Regional Overview of Conservation/Water Supply Management Events

1972	Goleta Water District (Goleta) declares Emergency Water Shortage and moratorium on new connections.
1973	Montecito Water District (Montecito) Water Shortage Emergency and moratorium on new connections declared; allocations established for each account.
1976-77	Critically dry years in northern California.
1979	Montecito authorizes a limited number of new service connections.
1982	Goleta and City of Santa Barbara (Santa Barbara) Overlap agreement signed, transferring approximately 1,000 acre feet of demand from Goleta to the City.
1982	Annual South Coast Xeriscape Seminar initiated.
1986	**Rainfall: 20 Inches**
1986	Santa Barbara City water conservation campaign conducted by the Community Environmental Council.
1986	Goleta's ULF toilet rebate program begins.
April 1986	Santa Barbara's temporary suspension of development applications declared.
1987	**Rainfall: 15.3 Inches** (81% of normal)
1987	Voters in Goleta approve Measure T, which allows a limited number of new service connections to be issued.
1988	**Rainfall: 13.5 Inches** (72% of normal)
1987	Goleta's free low-flow showerhead distribution program began.
1987	Joint Santa Barbara/Goleta water conservation promotion began.
1987-88	Critically dry years in northern California.
1988	Montecito begins to offer water audits.
April 1988	Adoption of Santa Barbara City's Comprehensive Water Conservation Program.
1988 (August)	Santa Barbara ULF toilet rebate and low-flow showerhead distribution programs initiated.
1989	**Rainfall: 5.8 Inches** (31% of normal)
1989	Montecito begins comprehensive water conservation program, including the distribution of low-flow showerheads.

1989 (February) Goleta opens water conservation office and initiates water conservation hotline.

1989 (March) Santa Barbara Stage I Drought Condition declared; voluntary conservation of 10% requested.

May 1989 Goleta begins water rationing aimed at 15% reduction.

July 1989 Santa Barbara block rate billing initiated.
Goleta raises water rates by approximately 25%.

November 1989 Gibraltar Reservoir emptied. (City of Santa Barbara water supply)

1990 **Rainfall: 5.5 Inches** (31% of normal)

January 1990 Santa Barbara Stage II Drought Condition declared and Water Conservation Hotline initiated.

February 1990 Santa Barbara Stage III Drought Emergency Condition declared; Lake Cachuma projected to be empty by spring 1992 without significant rainfall, causing Cachuma allotments to be reduced to 55% of entitlements.

March 1990 Notice of Stage III water rates mailed to all Santa Barbara customers.

May 1990 Santa Barbara Stage III rates (steeply inclining block rates) take effect.

July 1990 Goleta water rates increased and block pricing eliminated.

July 1990 Montecito begins block rate pricing for the domestic billing classification.

1990 Critically dry year in northern California.

January 1991 Montecito raises water rates 300%.

February 1991 Lake Cachuma drops to 14% of capacity.

March 1991 "March Miracle" rainfall occurs, dropping 22 inches of rain at Lake Cachuma; Gibraltar Reservoir spills.

April 1991 Santa Barbara lifts lawn watering ban.

June 1991 State water importation approved by voters in Goleta, Santa Barbara and Montecito; Santa Barbara voters also approve desalination plant.

October 1991 Santa Barbara Stage III Drought Condition downgraded to Stage II.

February 1992 Goleta suspends water rationing.

February 1992 "Fantastic February" - rainfall during February and March sufficient to bring Lake Cachuma to approximately 90% storage capacity.

March 1992	Montecito authorizes a limited number of new service connections.
March 1992	Emergency desalination plant completed; Santa Barbara suspends Stage II Drought Condition.
April 1992	Montecito suspends water allocation program initiated in 1973.

Observations of Staff From Local Water Districts After the Drought

City of Santa Barbara:

Significant demand reduction was achieved during the drought emergency period in the City due to many variables.

Customer assistance was extremely important, and in the City it contributes significantly to an awareness of methods to conserve water. Free water audit were offered to customers and were especially encouraged when customers call concerning a high water bill. The water audit program was successful in achieving water savings and good customer relations. By going out to the customer's property, rather than just discussing the problem on the phone, the inspector was able to view the problems and make specific recommendations. Customers were pleased to have City staff take the time to assist them, and often leaks or other problems were solved by the visit.

Another effective element of the City's Water Conservation Program was public information and promotion. By educating the public about the water supply status and water conservation, they become interested and involved. Many residents felt a sense of civic duty to conserve as much water as possible during the drought emergency. The City's policies and programs were promoted through as many avenues as possible. Traditional paid advertising, as well as many creative and inexpensive means, were used.

One method of encouraging plumbing fixture retrofits was particularly successful. The higher tier in the block rates was dropped for customers in the multi-family dwelling classification that retrofit toilets and showerheads to water efficient models, install aerators, and repair leaks.

Goleta Water District:

The Goleta Water District's water conservation/rationing programs achieved a high rate of customer awareness and participation, significant reductions in demand, and one of the lowest per capita water use rates in Southern California.

An important aspect of the conservation/rationing program was public information and assistance. The Conservation Office and Conservation Hotline provided customers with an information and assistance resource that enabled them to achieve significant water savings. Rationing was mandatory, but customers were allowed to choose which methods they would use to reduce their water use. Having a wide variety of conservation options helped achieve a high level of compliance with minimal inconvenience to the public. The District favored this approach over that of banning specific water uses.

A significant feature of this type of program was providing the public with as much information as possible, going on the assumption that a well-informed community will be more responsive to agency efforts. Withholding information to avoid a negative public response will only damage an agency's credibility in the long run. Assume that the public cares and wants to be informed.

The toilet rebate and showerhead give-away programs demonstrated the value of combining public information programs with incentives to achieve high levels of program participation. The toilet rebate program also worked particularly well in combination with the allocation appeal program during rationing. Customers requesting an increased allocation were required to install ULF toilets and low-flow showerheads , but received a rebate on the toilet and free showerheads.

Montecito Water District:

The following are factors that contributed to the reduction of water demand:

- Restrictive allocation programs with heavy surcharge penalties for exceeding the allocation.
- Public information on the status of the current water supplies available and conservation techniques.
- Retrofitting of plumbing fixtures and irrigation systems.
- Information on the drought emergency from newspaper, radio, etc.
- Increased water rates.
- Pressure from neighbors and the community to reduce water consumption.

Residents have become more aware in the past thirty years of the limits of water supplies in this area. While additional supplies of desalinized water and State Water will increase the amount of water available, the high cost of water will continue to encourage people to use it efficiently.

CONCLUSIONS

Influence Of The Media

The media helped increase public awareness of the drought situation, while at the same time distorting the effects that rationing and conservation were having on the community. The media tended to give attention to dramatic situations that were not representative of the community as a whole, and thus often presented a much bleaker picture of the situation than actually existed. For instance, interviewing only customers whose landscape had died or those that had retrofitted their toilets and were dissatisfied. The majority of the community seemed to be successfully coping with the drought restrictions, but this was not considered news-worthy.

Some media tactics, such as printing photos of the dry, cracked mud from the bottom of the local reservoir, also had a positive affect. After seeing such photos in the newspaper, local residents often commented that they had been more inspired in their conservation efforts. However, when this same picture was viewed by residents in communities in other parts of the state or country, it may have had the negative affect of decreasing tourism as travelers avoided what they perceived as a disaster area.

One recommendation for successfully working with the local media, to use them as allies, is to encourage them to present the positive, everyday efforts of residents as well covering the sensational stories. It is difficult to achieve a 100% accurate representation, but keeping the media informed through press releases or press conferences will help to mitigate the negative affects of dramatized or one-sided reporting.

Community Response

To summarize the response of the local community to the drought emergency, the level of water savings achieved was significantly higher than requested by water officials. Because of ample media coverage, local water users could see for themselves the severity of the water shortage (low lake levels) and they understood that they were entirely dependent on these very limited local water supplies.

As a result of the water shortage emergency, in 1991 each of the three water districts sought, and obtained, voter approval for construction of facilities to import State Water. Additionally, the City of Santa Barbara voted to convert the temporary emergency desalination plant to a permanent facility. The Board of Directors of the Goleta Water District agreed to buy water from the Santa Barbara desalination plant. Montecito Water District voters agreed to purchase water from the desalination plant on a temporary, emergency basis. This approval of new water sources by voters and elected Board members came during the drought, while everyone was still feeling the affects of rationing and restrictions. In light of the cost of these two new water sources (State Water and desalinated water), and the fact that local reservoirs filled to capacity during the Winter of 1993, some customers within the three districts later questioned whether both projects were needed.

Suggestions For Implementing Drought Conservation Programs

When implementing a water conservation/demand management program in response to a water supply emergency, many elements are developed by trial and error. The following are ideas and suggestions to consider when developing and implementing a water demand management program during a period of water supply shortage. Some of these ideas will also apply to establishing a long-term conservation program.

Program Equity:

Public input is useful in creating equitable programs. It is impossible to create a program that is acceptable to everyone, but customers often have good suggestions for dealing with questions of "fairness". This is most applicable in water rationing or allocation type programs where customer accounts have different allotment sizes.

While not always popular, banning certain practices, such as lawn watering, which are considered non-essential, may be equitable conservation measures. Such restrictions affect lower and upper income accounts equally, i.e. the ability to engage in a certain type of water use is not dependent on the ability to pay a higher water bill.

When creating a rationing program, property size should be taken into account, regardless of whether allocations or tiered water pricing systems are used. Larger properties have a higher need for irrigation, even during a drought, in order to protect trees or established shrubs. This could be taken into account by creating a different account classification for larger properties, with appropriate price-block sizes.

Public Information Development:

When developing public information materials, it is useful to have them proof-read by someone not associated with your agency. Ideas that seem simple and unambiguous to staff may not be as clear to members of the public.

Be sure to include clear definitions of terms used in explaining conservation programs. Information that may seem very basic, such as the units of water used on a customer's bill, may be an unfamiliar term to the customer.

Staff Management:

It is important for information to flow smoothly among staff during a water supply emergency. Conservation employees and others who deal with the public should be updated regularly so that information going out to customers is consistent and accurate.

Regular staff meetings can facilitate the flow of information and provide moral support for employees who may have to deal regularly with members of the public who are angry or frustrated.

Staff on the "front lines" implementing water conservation programs may have valuable input on decisions faced by the Board of Directors. A line of communication between Board members and staff can help to efficiently gather staff input before making decisions that affect ongoing programs or staff work load.

Better staff communication can result in more consistent and equitable policies, as well as less frustration on the part of the staff and the public.

Water Pricing Strategies:

Rate increases should include all user categories, i.e. not excluding a certain rate category or tier. This helps relay the message that all water users will share equally in the cost of the water supply emergency.

Because water sales fluctuate each month, revenue during a water supply emergency may not be predictable. If additional funding is needed for supplemental water supplies, the use of increased service charges may be more reliable as a revenue generator.

Monitoring the Effectiveness of Programs:

The best way to track water use by each account in order to monitor the effectiveness of conservation programs is through computerized billing systems. Databases can often be altered to include information on accounts such as participation in water audit, toilet rebate, or low-flow showerhead programs.

If computerized records are not possible, consider instituting other tracking methods at the beginning of the program. This can mean simply keeping "hard copy" files of information, for instance on customers who install low-flow showerheads, ULF toilets, or receive water audits. After the program is well underway it may be more difficult to extract information that can reveal program effectiveness or weaknesses.

A customer survey may be used to determine which conservation programs/techniques are most often used or preferred by customers. Such a survey could give insight into difficult-to-quantify programs such as public information or school education programs. Rigorous survey design is important in order to avoid inappropriate conclusions.

Sewer flow records provide a means of separating the reduction in indoor water use from reductions in outdoor use. This may be useful in programs that include strong reduction incentives in both use categories.

Summary of Recommendations

Based on the experiences of the water districts on the South Coast of Santa Barbara County during the prolonged drought of 1986-92, the following recommendations are made for addressing future droughts. These recommendations are based on what worked, what didn't work and lessons learned by local water districts during this

- Prepare a comprehensive drought contingency plan including water supply and demand scenarios during multiple dry years so that you fully understand the district supplies and what steps will be taken to increase supplies or reduce demand when shortages occur.

- Plan ahead by setting aside water supplies (drought buffer) and funding reserves to offset temporary revenue shortfalls during periods with lower water sales.
- Implement water conservation pricing structure at all times; implement drought pricing structure in early stages of drought to encourage maximum efficiency and minimize wasteful use.
- Coordinate drought response programs among purveyors in the region for consistency, equity and to minimize confusion among water users regarding which programs are in effect in their area.
- Establish programs that are equitable (do not favor customers in higher income brackets) and do not penalize customers that been conserving all along (i.e., by creating an allocation program that reduces customer's allotment to a percentage of past use).
- Maintain credibility with customers by conducting an honest, open and intensive public information campaign throughout the drought. Keep customers informed about water situation, the impact of their conservation efforts and the ongoing need to conserve. Use many mediums to keep public informed such as bill inserts, radio/tv advertising, newspaper articles and advertising, presentations to local service clubs and organizations, neighborhood workshops, newsletters and other means typically used by local purveyors to educate customers.
- Offer options for customers regarding how they save water during early stages of drought. For example, provide an allocation and let them choose how they will use the water. One customer may want to keep their landscape thriving (with efficient irrigation practices, of course) and choose not wash their vehicles, while another customer may want to let their lawn die and still wash their vehicles. Save the severe restrictions (i.e. no lawn watering) for later stages when higher levels of conservation are necessary.
- Create a citizens' committee to obtain feedback from customers and to keep the community informed about the purveyor's decisions, particularly regarding transitions between stages of action.
- Establish a reasonable rationing program and enforce it equitably. Customers will notice if districts do not enforce the restrictions or prohibitions consistently.

SECTION 7

GLOSSARY

GLOSSARY

A

ABANDONED WATER RIGHT - A water right which was not put to beneficial use for a number of years, generally five to seven years.

ABANDONED WELL - A well, which is no longer used. In many places, abandoned wells must be filled with cement or concrete grout to prevent pollution of ground water bodies.

ACRE-FOOT - The quantity of water required to cover one acre to a depth of one foot; equal to 43,560 cubic feet, or approximately 325,851 gallons.

ADJUDICATION - A court proceeding to determine all rights to the use of water on a particular stream system or ground water basin.

AGRICUTLURAL ACCOUNT

ALLUVIAL - Sediment deposited by flowing water, such as in a riverbed.

APPLIED WATER DEMAND - The quantity of water that would be delivered for urban or agricultural applications if no conservation measures were in place.

AQUIFER - An underground layer of rock, sediment or soil that is filled or saturated with water.

ARTIFICIAL RECHARGE - The addition of water to a ground water reservoir by human activity, such as irrigation or induced infiltration form streams, wells, or recharge basins. See also GROUNDWATER RECHARGE, RECHARGE BASIN.

B

BRACKISH WATER - Water containing dissolved minerals in amounts that exceed normally acceptable standards for municipal, domestic, and irrigation uses. Considerably less saline than sea water.

C

COMMERCIAL ACCOUNT - Any water user that provides or distributes a product or service, such as hotels, restaurants, office buildings, commercial businesses or other places of commerce. These do not include multi-family residences, agricultural users, or customers that fall in the industrial or institutional classification.

CONJUNCTIVE USE – The coordinated management of surface water and groundwater supplies to increase the total overall yield. Wet year water can be stored by injection or surface recharge to increase dry year supplies.

CONSERVATION - As used in this report, urban water conservation includes reductions realized from voluntary, more efficient, water use practices promoted through public education and from state-mandated requirements to install water-conserving fixtures in newly constructed and renovated buildings. Agricultural water conservation, as used in this report, means reducing the amount of water applied in irrigation through measures that increase irrigation efficiency. See NET WATER CONSERVATION.

CRITICAL DRY PERIOD - A series of water-deficient years, usually an historical period, in which a full reservoir storage system at the beginning is drawn down (without any spill) to minimum storage at the end.

CRITICAL DRY YEAR - A dry year in which the full commitments for a dependable water supply cannot be met and deficiencies are imposed on water deliveries.

CUBIC FEET PER SECOND - A unit of measurement describing the flow of water. A cubic foot is the amount of water needed to fill a cube that is one foot on all sides, about 7.5 gallons.

D

DESALINATION the process of salt removal from sea or brackish water.

DWR - California Department of Water Resources (or successor agency).

E

EFFECTIVE PRECIPITATION - The part of precipitation which produces runoff; a weighted average of current and antecedent precipitation "effective" in correlating with runoff. It is also that part of the precipitation falling on an irrigated area which is effective in meeting the requirements of consumptive use.

F

FIRM YIELD - The maximum annual supply of a given water development that is expected to be available on demand, with the understanding that lower yields will occur in accordance with a predetermined schedule or probability.

G

GREYWATER - Wastewater from clothes washing machines, showers, bathtubs, handwashing, lavatories and sinks that are not used for disposal of chemical or chemical-biological ingredients.

GROUNDWATER - Water that occurs beneath the land surface and completely fills all pore spaces of the alluvium or rock formation in which it is located. *As a source category for the drought plan tables* - All water withdrawn by the district through district owned/operated wells.

GROUNDWATER BASIN - A groundwater reservoir, together with all the overlying land surface and underlying aquifers that contribute water to the reservoir.

GROUNDWATER MINING - The withdrawal of water from an aquifer greatly in excess of replenishment; if continued, the underground supply will eventually be exhausted or the water table will drop below economically feasible pumping lifts.

GROUNDWATER OVERDRAFT - The condition of a groundwater basin in which the amount of water withdrawn by pumping exceeds the amount of water that replenishes the basin over a period of years.

GROUNDWATER RECHARGE - Increases in groundwater by natural conditions or by human activity. See also ARTIFICIAL RECHARGE.

GROUNDWATER STORAGE CAPACITY - The space contained in a given volume of deposits. Under optimum use conditions, the usable groundwater storage capacity is the volume of water that can, within specified economic limitations, be alternately extracted and replaced in the reservoir.

GROUNDWATER TABLE - The upper surface of the zone of saturation (all pores of subsoil filled with water), except where the surface is formed by an impermeable body.

I

INDUSTRIAL ACCOUNT - Any water users that are primarily manufacturers or processors of materials as defined by the Standard Industrial Classifications (SIC) Code Numbers 2000 through 3999.

INSTITUTIONAL ACCOUNT - Any water using establishment dedicated to public service. This includes schools, courts, churches, hospitals, and government facilities.

M

MULTI-FAMILY SERVICE CONNECTION – More than one dwelling unit per meter.

M&I - Municipal and Industrial (water use); generally urban uses for human activities.

mg/L - Abbreviation for "milligrams per Liter," the mass (milligrams) of any substance dissolved in a standard volume (liter) of water. Nearly the same as parts per million (ppm).

N

NET WATER CONSERVATION - The difference between the amount of applied water conserved and the amount by which this conservation reduces usable return flows.

NET WATER DEMAND - The applied water demand less water saved through conservation efforts (= net applied water = actual water used).

NONPOINT SOURCE - A contributing factor to water pollution that cannot be traced to a specific spot.

O

OVERDRAFT - Withdrawal of groundwater in excess of a basin's perennial yield. See also PROLONGED OVERDRAFT.

P

PERCOLATION - The downward movement of water through the soil or alluvium to the groundwater table.

PERENNIAL YIELD - "The rate at which water can be withdrawn perennially under specified operating conditions without producing an undesired result" (Todd, 1980). An undesired result is an adverse situation such as: (1) a reduction of the yield of a water source; (2) development of uneconomic pumping lifts; (3) degradation of water quality; (4) interference with prior water rights; or (5) subsidence. Perennial yield is an estimate of the long-term average annual amount of water that can be withdrawn without inducing a long-term progressive drop in water level. The term "safe yield" is sometimes used in place of perennial yield, although the concepts behind the terms are not identical: the older concept of "safe yield" generally implies a fixed quantity equivalent to a basin's average annual natural recharge, while the "perennial yield" of a basin or system can vary over time with different operational factors and management goals.

PROLONGED OVERDRAFT - Net extractions in excess of a basin's perennial yield, averaged over a period of ten or more years.

ppm - Abbreviation for "parts per million," a measure of a substance's concentration in a solution or other mixture. Nearly the same as milligrams per liter (mg/L).

R

RECHARGE BASIN - A surface facility, often a large pond, used to increase the infiltration of water into a groundwater basin.

RECREATIONAL SERVICE CONNECTION – Services to public golf courses, parks, sports centers/grounds.

RECYCLED WASTEWATER - Urban wastewater that becomes suitable for a specific beneficial use as a result of treatment. *As a source category for the drought plan tables* - The total capacity of wastewater that is treated to an appropriate level for beneficial use by the district.

RETURN FLOW - The portion of withdrawn water that is not consumed by evapotranspiration and returns instead to its source or to another body of water.

REUSE - The additional use of once-used water.

RWQCB - California Regional Water Quality Control Board (or successor agency).

S

SAFE YIELD (GROUNDWATER) - The maximum quantity of water that can be withdrawn from a groundwater basin over a long period of time without developing a condition of overdraft. Sometimes referred to as sustained yield.

SALINITY - Generally, the concentration of mineral salts dissolved in water. Salinity may be measured by weight (total dissolved solids), electrical conductivity, or osmotic pressure. Where seawater is the major source of salt, salinity is often used to refer to the concentration of chlorides in the water. See also TDS.

SERIOUS OVERDRAFT - Prolonged overdraft that results, or would result, within ten years, in measurable, unmitigated adverse environmental or economic impacts, either long-term or permanent. Such impacts include but are not limited to seawater intrusion, other substantial quality degradation, land surface subsidence, substantial effects on riparian or other environmentally sensitive habitats, or unreasonable interference with the beneficial use of a basin's resources. (Also see Policy 3.5 et seq. in main text.)

SINGLE FAMILY SERVICE CONNECTION – One dwelling unit per meter

SURFACE WATER – Water above the surface of the land, including lakes, rivers, streams, ponds, floodwater and runoff.

SWP - State Water Project.

SWRCB - California State Water Resources Control Board (or successor agency).

T

TDS - Total Dissolved Solids, a quantitative measure of the residual minerals dissolved in water that remain after evaporation of a solution. Usually expressed in milligrams per liter (mg/l) or in parts per million (ppm). See also Salinity.

TURBIDITY - A measure of cloudiness and suspended sediments in water. Water high in turbidity appears murky and contains sediments in suspension. Turbid water may also result in higher concentrations of contaminants and pathogens, that bond to the particles in the water.

U

ULF – Ultra-Low Flush; A term used to describe water efficient toilets now required by state law in new construction.

W

WATER QUALITY - A term used to describe the chemical, physical, and biologic characteristics of water with respect to its suitability for a particular use.

WATER RIGHT - A legally protected right, granted by law, to take possession of water occurring in a water supply and to divert the water and put it to beneficial uses.

WATERSHED - The area or region drained by a reservoir, river, stream, etc.; drainage basin.

WATER TABLE - The surface of underground, gravity-controlled water.

DROUGHT PLAN

This section includes copies of all of the tables that should be included in your drought plan. By using the Practice Worksheets located in Sections 1 through 7 of this document, you should be able to complete each of the following tables. Once the tables are completed, you will have a drought plan that should be adopted by resolution by your governing board.

Adopting Your Plan

Once you have completed Tables 1 through 18, you have all of the materials and information necessary for a complete drought plan for your district. The next step is to compile the plan in a manner which will be the most useful for you district. Then your district should officially adopt the plan so that the plan can be implemented as soon as it becomes apparent that a water shortage is imminent. The steps listed below provide a guide for adopting your plan.

1. Announce through local media that draft copies of your drought plan are available for review.
2. Set Public Meeting dates to provide the public with a forum for providing comments.
3. Incorporate comments into the draft Drought Plan to create your Final Plan.
4. Adopt the Drought Plan through an ordinance.
5. Send official copies of your plan to the Bureau of Reclamation, the California Department of Water Resources, and neighboring water districts.

Drought Plan Cover Sheet

District Name: _____

District Address: _____

Name of Person(s) Completing Drought Plan:
_____

Bureau Plan Required (Over 2000 service connections?):
____ Yes ____ No

DWR Urban Water Management Plan Required(Over 3000 service connections or over 3000 acre-feet served?): ____ Yes ____ No

Has your agency previously prepared a Drought Plan? ____ Yes ____ No

Table 1

Available Water Supplies* (Shown in Calendar Years)			
SOURCE*	**2000**	**2005**	**2010**
Surface Water			
1.			
2.			
3.			
Groundwater			
Recycled Wastewater			
Imported Water(Central Valley Project or State Water Project)			
Sales to Other Agencies			
Totals			
*Units of Measure: Acre-feet/Year			

**See Glossary for further explanation of categories*

Table 2

Number of Service Connections By Customer Type* (Shown in Calendar Years)			
Customer Sector	**2000**	**2005**	**2010**
Single Family			
Multi-Family			
Commercial			
Institutional			
Institutional			
Recreation			
Agriculture			
Total			

**See Glossary for further explanation of categories*

Table 3

Past, Current and Projected Water Use (Shown in acre-feet per Calendar Year)					
Customer Sector	**1990**	**1995**	**2000**	**2005**	**2010**
Single Family					
Multi-Family					
Commercial					
Institutional					
Industrial					
Recreation					
Agriculture					
Unaccounted Loss					
Total					

Table 4

Population and Per-Capita Demand			
	2000	**2005**	**2010**
Population			
Per-Capita Demand (gallons per person per day)			

Table 5

Projected Supply and Demand Comparison (Acre-feet/Year)			
	2000	**2005**	**2010**
Supply totals			
Demand totals			
Difference			

Table 6

SUPPLY RELIABILITY (Acre-Feet Per Year)				
		Multiple Dry Years		
Average/ Normal Water Year	**Single Dry Water Year 20% reduction in supply**	**Year 1 Volume 10% reduction in supply**	**Year 2 Volume 15% reduction in supply**	**Year 3 Volume 20% reduction in supply**

Table 7

Water Production and Delivery Costs ($Per Acre-Foot)	
Surface Water	
1.	
2.	
3.	
Groundwater	
Imported Water	
Recycled Wastewater	

Table 8

Water Rates to Customers ($ Per Hundred Cubic Feet)	
Customer Class	**Rate**
Single Family	
Block 1	
Block 2	
Block 3	
Multi-Family	
Block 1	
Block 2	
Block 3	
Commercial	
Block 1	
Block 2	
Block 3	
Industrial	
Recreation	
Landscape	
Block 1	
Block 2	
Public	
Institutional	
Agriculture	

Table 9

Hypothetical Worst-Case Planning Scenario Statewide and Local Drought						
Source of Supply	**Average Year Water Supply Available (Acre-feet)**	**Multiple Dry Water Years** (Acre-feet)				
		Year 1 2001	**Year 2 2002**	**Year 3 2003**	**Year 4 2004**	**Year 5 2005**
Total Supply Sources						
Percent Supply Shortage		10%	20%	30%	40%	50%
Total Demand (assume average year demand levels)						
Difference						

Table 9A

Hypothetical Worst-Case Planning Scenario Statewide and Local Drought Supply Augmentation Option						
Source of Supply	**Average Year Water Supply Available (Acre-feet)**	**Multiple Dry Water Years** (Acre-feet) **Year 1 2001**	**Year 2 2002**	**Year 3 2003**	**Year 4 2004**	**Year 5 2005**
Total Supply Sources						
Percent Supply Reduction		10%	20%	30%	40%	50%
New Supplies 1. 2. 3.						
Total Demand (assume average year demand levels)						
Difference						

Table 9B

Hypothetical Worst-Case Planning Scenario Statewide and Local Drought Demand Reduction Option						
Source of Supply	**Average Year Water Supply Available (Acre-feet)**	**Multiple Dry Water Years** (Acre-feet)				
		Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Total Supply Sources						
Percent Supply Shortage		10%	20%	30%	40%	50%
Percent Demand Reduction		5%	10%	15%	20%	25%
Total Demand						
Difference						

Table 9C

Hypothetical Worst-Case Planning Scenario Statewide and Local Drought Simultaneous Supply Augmentation and Demand Reduction Option						
Source of Supply	**Average Year Water Supply Available (Acre-feet)**	**Multiple Dry Water Years** (Acre-feet)				
		Year 1 2001	**Year 2 2002**	**Year 3 2003**	**Year 4 2004**	**Year 5 2005**
Total Supply Sources						
Percent Supply Shortage		10%	20%	30%	40%	50%
New Supplies 1. 2. 3.						
Percent Demand Reduction		5%	10%	15%	20%	25%
Total Demand						
Difference						

Table 10

Triggers for Implementing Drought Plan	
Stage 1 – Minimal	**____** Total Supply Reduction
Stage 2 – Moderate	____ Total Supply Reduction
Stage 3 – Severe	____ Total Supply Reduction
Stage 4 – Critical	____ Total Supply Reduction

Table 11

ACTIONS FOR YOUR DROUGHT STRATEGY	STAGE
Methods to Increase Existing Supplies	
Increase use of recycled wastewater	
Increase use of nonpotable water for nonpotable uses	
Construct emergency dams	
Re-activate abandoned dams	
Drawing From Reserve Supplies	
Use reservoir dead storage	
Add wells	
Deepen wells	
Re-activate abandoned wells	
Rehabilitate operating wells	
Renegotiate contractually controlled supplies	
Methods to Increase Efficiency	
Suppress reservoir evaporation	
Reduce dam leakage	
Minimize reservoir spills	
Reduce distribution system pressure	
Conduct distribution system water audit	
Conduct distribution system leak detection and repair	
Surge and clean wells	
Modifications to Operations	
Re-circulate wash water	
Blend primary supply with water of lesser quality	
Transfer surplus water to areas of deficit	
Change pattern of water storage and release operations	
Cooperative Efforts with Other Agencies	
Exchanges	
Transfers or interconnections	
Mutual aid agreements	
Demand Reduction Actions	
Residential Plumbing Retrofit	
System Water Audits, Leak Detection And Repair	
Metering with Commodity Rates for All New Connections and Retrofit of Existing Connections	
Large Landscape Conservation Programs And Incentives (applies only to non-residential accounts with large landscaped areas)	
High-Efficiency Washing Machine Rebate Programs	
Public Information Programs	
School Education Programs	
Conservation Programs For Commercial, Industrial, And Institutional (CII) Accounts	

Wholesale Agency Assistance Programs	
Conservation Pricing	
Conservation Coordinator	
Water Waste Prohibition	
Residential Ultra Low Flow Toilet Replacement Programs	
Implement all applicable pre-stage 1 measures	
Provide technical assistance to customers	
Begin public information campaign– drought message	
Ask customers for voluntary reductions in use	
Provide incentives to customers to reduce water consumption (rebates, free devices)	
Prohibit wasteful use of water	
Limit number of building permits issued	
Implement water shortage rate structure (Change the water rate structure from a uniform rate to an inclining block rate)	
Plumbing fixture replacement	
Request increased reduction by customers	
Require that eating establishments serve water only when specifically requested by customers	
Prohibit use of running water for cleaning hard surfaces such as sidewalks, driveways, and parking	
Require lodging hotels/motels to post notice of drought condition with tips in each guest room	
Provide weekly updates on supply conditions to media and public	
Prohibit some uses of water – i.e., lawn watering using sprinklers	
Institute rationing programs through fixed allotments or percentage cutbacks	
Reduce pressure in water lines	
Prohibit use of ornamental fountains and ponds, except when water is re-circulated (include a sign adjacent to the fountain stating that the water in the fountain is being re-circulated)	
Prohibit filling swimming pools and spas unless the pool or spa is equipped with a pool cover	
Prohibit the use of potable water for cleaning, irrigation and construction purposes, including but not limited to dust control, settling of backfill, flushing of plumbing lines, and washing of equipment, buildings and vehicles	
Vehicles and boats can only be washed at a car wash that recycles water or uses 10 gallons or less of water per cycle or with a bucket and hose equipped with a	

automatic shut-off nozzle	
Intensify implementation of all measures in previous stages	
Implement mandatory water rationing including per-capita water use allocations for residential customers	
Restrict water use only to priority uses (no lawn watering, car washing)	

Table 12

Menu of Options for Public Outreach

Public Awareness Program	**Options to be Implemented**
Bill Inserts for water bills	
Public service advertising – run for free by local media	
Paid Advertising – Newspaper	
Paid Advertising – Radio	
Paid Advertising – Television	
Paid Advertising – Movie Slides for local movie theaters	
Paid Advertising – Chamber of Commerce Newsletter	
District newsletter	
Classroom Presentations	
Drought Pamphlet – mass distribution to all customers	
Drought Website	
Public Workshops – Drought Survival – Water conservation	
Drought Information Center	
Public Advisory Committee	
Displays in District Office	
Low flow fixture rebates	
Low flow fixture distribution	
Promote use of Greywater	
Drought Tolerant Plant Tagging Program at local nurseries	
Promoting CIMIS information	
Drought Hotline	
Water Audits	
Displays in Public Libraries, at local schools, shopping malls, etc.	
Bus ads	
Billboards	
Promotional Items with a conservation message (mugs, rulers, stickers, pens)	

Table 13

Media List				
TV Stations	**Contact**	**Address**	**Phone/Fax**	**Email**
Include Government Access Channels				
Print Media				
Include newspapers from local colleges				
Include news clipping services				
Radio Stations				
Chambers of Commerce				
Politicians				
County Board of Supervisors				
City Council				
Assembly				
Congress				

Table 14

Projected Ranges of Water Sales by Stage					
	Normal	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**
Water Sales - Acre Feet per Year					
Urban					
Agricultural					
Total Acre-Feet per Year					
* Be sure to change percentages in formulas to match drought stage percentage reductions chosen by the district.					

Table 15

Revenues and Expenditures (No additional water purchases and no rate increases)					
	Normal	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**
Operating Revenues					
Urban					
Agricultural					
Total Water Sales					
Meter Charges					
Total Revenue					
% reduction					
Operating Expenses					
salaries					
overhead					
cost of supply					
production and purification					
transmission and distribution					
customer accounts					
general and administrative					
depreciation					
capital projects					
Total Operating Expenses					
Surplus or (Deficiency)					

Table 16

Project Worst Case Water Supply with Associated Costs					
	Normal	**Drought Year 1**	**Drought Year 2**	**Drought Year 3**	**Drought Year 4**
Supply and Cost					
Reservoir					
Acre-Feet					
$ per acre foot					
Groundwater					
Acre-Feet					
$ per acre foot					
Recycled Water					
Acre-Feet					
$ per acre foot					
Total Acre-Feet					
Cost of Supply					

Table 17

Projected Worst Case Water Supply With Associated Costs					
	Normal	**Drought Year 1**	**Drought Year 2**	**Drought Year 3**	**Drought Year 4**
Supply and Cost					
Reservoir					
Acre-Feet					
$ per acre foot					
Groundwater					
Acre-Feet					
$ per acre foot					
Recycled Water					
Acre-Feet					
$ per acre foot					
Water Bank					
Acre-Feet					
$ per acre foot					
Desalinated Water					
Acre-Feet					
$ per acre foot					
Total Acre-Feet					
Cost of Supply					